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**14. ABSTRACT (182 words)**

The overall purpose of this two-year project with a one-year no-cost extension was to use the aggregate data, meta-analytic approach to determine the effects of exercise on bone mineral density (BMD) at the femoral neck (FN) and lumbar spine (LS) in adult men and women 18 years of age and older. In both premenopausal and postmenopausal women, statistically significant and clinically relevant improvements were found for both FN and LS BMD ($p < 0.05$ for all). However, no such differences were observed in men. With respect to dose-response, several associations were found between exercise-induced changes in FN and LS among premenopausal and postmenopausal women but none for load rating. Insufficient data were available to examine load ratings in men. The results of this important work suggest that exercise improves BMD at the FN and LS in both premenopausal and postmenopausal women. However, insufficient evidence currently exists to support such an effect in men. A dire need exists for additional randomized controlled trials in men as well as dose-response studies using more valid and reliable load rating instruments in both men and women.

**15. SUBJECT TERMS**
Exercise, physical activity, physical fitness, osteoporosis, bone, bone mineral density, meta-analysis, systematic review, dose-response

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# I. INTRODUCTION

Bone health is critical for optimal performance and the prevention of fractures associated with low bone mineral density (BMD). The specific aims of this two year project that was granted a one-year no-cost extension focused on using the aggregate data meta-analytic approach to (1) determine the overall effects of ground reaction force exercise on BMD at the femoral neck (FN) and lumbar spine (LS) in adult humans $\geq$ 18 years of age, and (2) using recently developed load stimulus data for 48 different physical activities (walking, running, lower-body weight training, etc.),[1] examine the dose-response effects of exercise on BMD at the FN and LS in adult humans $\geq$ 18 years of age. The two-year funding period was granted a one-year no-cost extension in order to complete presentations and manuscripts.

# II. BODY

**A. Statement of Work –** As can be seen in the table below, all approved work has been accomplished.

| Task | Category | Description | Status |
|---|---|---|---|
| 1 | Data Sources | Search for pertinent literature dealing with the effects of exercise on bone mineral density in adults | Completed (Appendix A) |
| 2 | Study Selection | Select studies that meet inclusion criteria dealing with the effects of exercise on bone mineral density in adults | Completed (Appendix B) |
| 3 | Data Abstraction | Develop valid and reliable codebooks and code data dealing with the effects of exercise on bone mineral density in adults | Completed (Appendix C) |
| 4 | Statistical Analysis | Analyze and interpret data dealing with the effects of exercise on bone mineral density in adults | Completed (Appendix D & E) |
| 5 | Products | Present and publish results dealing with the effects of exercise on bone mineral density in adults | Completed (Appendix D & E) |

## B. Study-Specific Summary of Completed Research

We have learned much from the two years of funding and no-cost extension year that we were allowed for this project. As a result of this important support, we published 3 abstracts from presentations (see Appendix D) as well as three manuscripts in peer-reviewed biomedical journals (see Appendix E).[2-4] For ease of understanding and interpretation, we have divided this section into a concise description regarding (1) the effects of exercise on FN and LS BMD in postmenopausal women,[2] (2) the effects of exercise on FN and LS BMD in premenopausal women,[3] and (3) the effects of exercise on FN and LS BMD in men.[4]

**1. Exercise and BMD at the FN and LS in postmenopausal women.** Osteoporosis is a major public health problem affecting an estimated 200 million women worldwide.[5] Congruent with osteoporosis is an increased risk for osteoporosis-related fractures, especially in women during the postmenopausal years, generally considered to begin around 50 years of age.[6] Comparatively, the lifetime risk of an osteoporosis-related fracture in women is equivalent to the risk of developing cardiovascular disease.[7] The two most common sites for osteoporosis-related fractures are the hip and the spine, with an estimated worldwide

prevalence of 1.1 million and 862,000, respectively, in women 50 years of age and older in the year 2000.[6] In the United States, the total annual costs associated with osteoporosis-related fractures were more than $19 billion in 2005 with a predicted increase to $25.3 billion in 2025.[8] The majority of the costs in 2005 were attributed to fractures of the hip (72%) followed by the spine (6%).[8]

Ground (for example, jogging) and joint reaction (for example, strength training) force exercise has been recommended across the lifespan.[9-12] However, the results of previous randomized controlled exercise intervention trials have reached conflicting and underwhelming conclusions regarding the effects of ground reaction and/ or joint reaction force exercise on BMD at the femoral neck (FN) and lumbar spine (LS) in postmenopausal women.[13-37] The purpose of this study was to use the aggregate data meta-analytic approach to determine the effects of ground and/or joint reaction force exercise on BMD at the FN and LS in postmenopausal women.

A search of six electronic databases, cross-referencing from retrieved studies, hand searching selected journals, and expert review, resulted in the inclusion of 25 of 1,182 studies representing 63 groups (35 exercise, 28 control) and up to 1775 participants that met the following criteria: (1) randomized controlled trials, (2) exercise intervention $\geq$ 24 weeks, (3) comparative control group, (4) postmenopausal women, (5) participants not currently participating in any type of regular joint and/or ground reaction force exercise, (6) published and unpublished (master's theses and dissertations) studies in any language since January 1, 1989 and (7) BMD (relative value of bone mineral per measured bone area or volume) assessed at the FN and/or LS using dual-energy x-ray absorptiometry (DEXA) or dual-photon absorptiometry (DPA).[13-37]

Using a random-effects model and standardized effect sizes (g) classified as either trivial (<0.20), small ($\geq$0.20 to <0.50), medium ($\geq$0.50 to <0.80), or large ($\geq$0.80),[38] an overall statistically significant benefit ($p = 0.002$) of ground and/or joint reaction force exercise on FN BMD was observed (Figure 1). In addition, non-overlapping confidence intervals (CIs) were observed. The number-needed-to-treat (NNT) was 6 with an estimated 127,968 postmenopausal US women experiencing benefit in FN BMD if they began and maintained a regular exercise program. A statistically significant association between increases in FN BMD and decreased compliance (combined aerobic and strength training groups only), decreases in BMI, decreases in body weight and decreases in percent body fat were observed ($p < 0.05$ for all). A trend ($p < 0.05$ but $\leq$ 0.10), for a statistically significant association was observed for increases in FN BMD and increases in intensity (strength only), increased compliance (strength training group only) and increases in static balance. No association was found between changes in FN BMD and load rating.

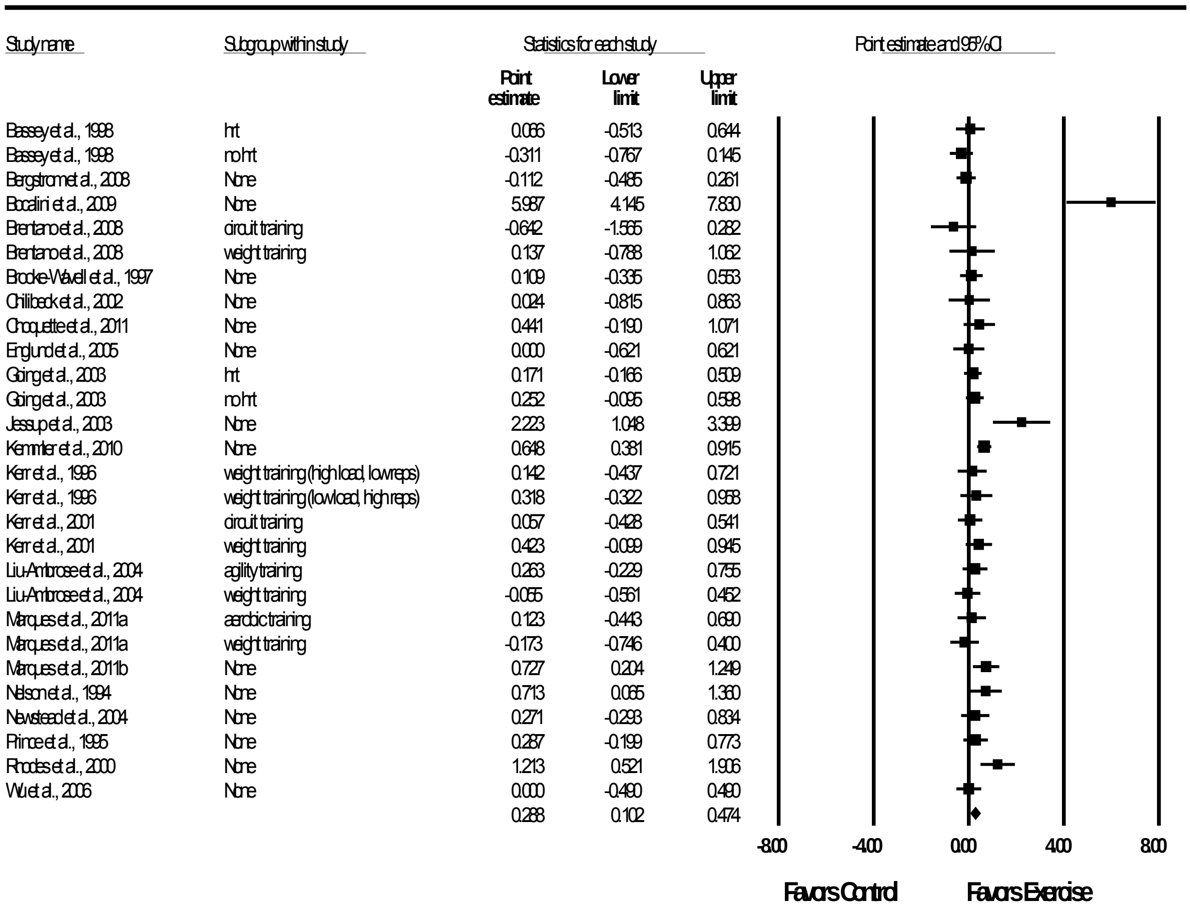


**Figure 1.** Forest plot for changes in FN BMD among postmenopausal women. The black squares represent the standardized mean difference (g) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (g) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. For subgroup, HRT means hormone replacement therapy.

A statistically significant benefit and slightly overlapping 95% CIs were observed for LS BMD (Figure 2). The NNT was 6 with an estimated 80,219 postmenopausal US women maintaining and/or increasing their LS BMD if they began and maintained a regular exercise program. Meta-regression analysis revealed a statistically significant association between increases in LS BMD and older age, greater number of years postmenopausal, fewer minutes of training per session (aerobic groups only), fewer minutes of training per week, greater intensity of training (strength only), increased compliance (strength only), decreased compliance (combined aerobic and strength training only), increases in static balance, decreases in BMI, body weight and percent body fat. A trend for a statistically significant association was found between increases in LS BMD and smaller increases in aerobic fitness as well as increases in lean body mass. No association was found between changes in LS BMD and load rating.

| Study name | Subgroup within study | Statistics for each study: Point estimate | Lower limit | Upper limit |
|---|---|---|---|---|
| Bassey et al., 1998 | hrt | -0.151 | -0.730 | 0.429 |
| Bassey et al., 1998 | no hrt | -0.030 | -0.483 | 0.423 |
| Bergstrom et al., 2008 | None | 0.023 | -0.350 | 0.396 |
| Bocalini et al., 2009 | None | 3.475 | 2.223 | 4.727 |
| Brentano et al., 2008 | circuit training | -0.970 | -1.922 | -0.019 |
| Brentano et al., 2008 | strength training | -0.367 | -1.298 | 0.565 |
| Brooke-Wavell et al., 1997 | None | 0.167 | -0.278 | 0.612 |
| Chilibeck et al., 2002 | None | -0.091 | -0.930 | 0.749 |
| Choquette et al., 2011 | None | -0.417 | -1.047 | 0.212 |
| Englund et al., 2005 | None | 0.242 | -0.381 | 0.864 |
| Going et al., 2003 | hrt | -0.079 | -0.416 | 0.257 |
| Going et al., 2003 | no hrt | 0.219 | -0.127 | 0.565 |
| Grove & Londeree, 1992 | high impact | 1.426 | 0.038 | 2.814 |
| Grove & Londeree, 1992 | low impact | 1.084 | -0.243 | 2.412 |
| Hong, 2004 | tai chi | -0.349 | -0.868 | 0.170 |
| Hong, 2004 | weight training | 0.376 | -0.134 | 0.887 |
| Iwamoto et al., 2001 | None | 1.029 | 0.166 | 1.892 |
| Jessup et al., 2003 | None | 1.124 | 0.130 | 2.118 |
| Kemmler et al., 2010 | None | 0.519 | 0.254 | 0.783 |
| Kerr et al., 2001 | circuit training | -0.159 | -0.645 | 0.326 |
| Kerr et al., 2001 | weight training | -0.310 | -0.830 | 0.209 |
| Marques et al., 2011 | None | 0.401 | -0.110 | 0.912 |
| Martin & Notelovitz, 1993 | 30 minutes | 0.043 | -0.585 | 0.671 |
| Martin & Notelovitz, 1993 | 45 minutes | 0.215 | -0.452 | 0.882 |
| Nelson et al., 1994 | None | 0.807 | 0.154 | 1.460 |
| Newstead et al., 2004 | None | 0.000 | -0.561 | 0.561 |
| Rhodes et al., 2000 | None | 0.379 | -0.264 | 1.021 |
| Wu et al., 2006 | None | -0.177 | -0.668 | 0.314 |
| | | 0.179 | -0.003 | 0.361 |

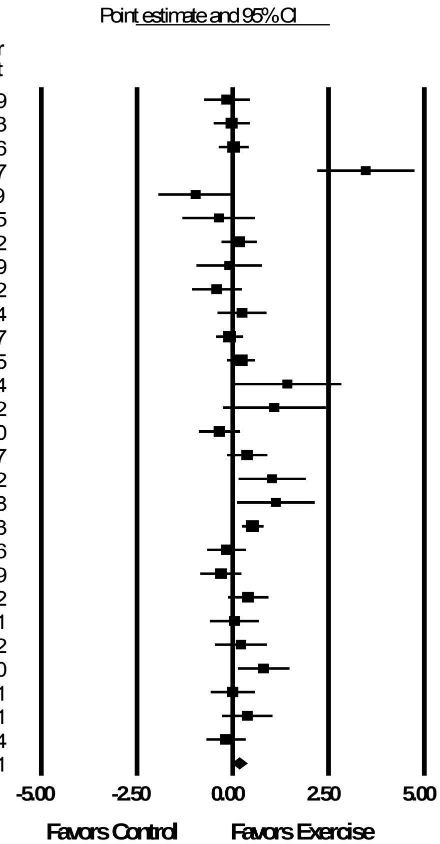


**Figure 2.** Forest plot for **c**hanges in LS BMD among postmenopausal women. The black squares represent the standardized mean difference (g) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (g) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. For subgroup, HRT means hormone replacement therapy.

The overall results suggest that ground and joint reaction force exercise may result in clinically important benefits in FN and LS BMD in postmenopausal women, with results more convincing for FN BMD. Based on previous prediction models,[39] the exercise-induced changes in BMD observed at the FN and LS in the current meta-analysis would reduce the 20-year relative risk of osteoporotic fracture at any site by approximately 11% and 10%, respectively.

Several interesting associations were found when simple meta-regression was performed for changes in FN and LS BMD. For both FN and LS BMD, greater increases were associated with both greater intensity and compliance in the strength training (joint-reaction force) groups. These findings suggest that greater loads per repetition as well as greater adherence may provide greater benefit to FN and LS BMD. Greater improvements in both FN and LS BMD were also associated with increases in static balance. These associations may be especially important for reducing the risk of falling as well as subsequent fracture risk. Greater increases in both FN and LS BMD were also associated with decreases in BMI, body weight and percent body fat. In addition, increases in LS BMD were associated with increases in LBM. All of these associations may be reflective of greater exercise effort. The

inverse association between increases in both FN and LS BMD with poorer compliance to aerobic and strength training protocols may be nothing more than the play of chance. Alternatively, studies with poorer compliance may have yielded greater benefits in FN and LS BMD because of the greater overall volume of training prescribed. For LS BMD, the positive association between increases in LS BMD and older age as well as a greater number of years postmenopausal may be the result of lower initial levels of BMD. However, we found no association between baseline LS BMD and changes in LS BMD. The negative associations between increases in LS BMD with shorter duration and total minutes of training per week for aerobic exercise studies may help to reinforce the belief that shorter duration activities such as jumping may be more beneficial to LS BMD than activities such as walking.[11] One potential reason for this negative association may be the result of calcium loss from excessive sweating in longer duration and/or higher intensity activities.[40;41] This causes a decrease in serum calcium followed by an increase in serum parathyroid hormone, which then stimulates bone resorption.[40;41] While these findings are interesting, further research is needed before any firm conclusions can be drawn.

A major interest of the investigative team was to examine the dose–response relationship between changes in FN and LS BMD and exercise load ratings in postmenopausal women. While we found no significant association between changes in FN and LS BMD and load ratings, these associations were based on general categorical estimates versus estimates specific to each activity.[1] The decision to use categorical estimates was based on the inability to accurately calculate load ratings for those studies that involved multiple types of activities. In addition, the algorithm used requires further testing, improvement and validation.[1] Future research should also focus on developing formulas for accurately calculating load ratings from data typically provided in randomized controlled intervention trials. Ideally, individual studies should collect and report force data in all exercise interventions. However, the accurate measurement of such may be challenging for some activities.[11] Until additional dose–response research is conducted, it would appear plausible to suggest that postmenopausal women adhere to the exercise guidelines from the American College of Sports Medicine.[12] These include weight-bearing endurance activities 3 to 5 times per week as well as resistance exercise 2 to 3 times per week.[12] However, it will be particularly important for future dose–response studies to determine whether increased duration of aerobic exercise diminishes the potential skeletal benefits, as suggested by the current regression analyses.

In conclusion, the overall findings of this aggregate data meta-analysis suggest that exercise may result in clinically relevant benefits to FN and LS BMD in postmenopausal women. However, future research regarding the dose-response relationship between exercise and FN and LS BMD are needed.

**Details regarding the aforementioned study in postmenopausal women can be found in the manuscript located in Appendix E, pages 287-305.**

**2. Exercise and BMD at the FN and LS in premenopausal women.** Maintaining optimal bone mineral density (BMD) levels during the premenopausal years is important for reducing the risk of osteoporosis and subsequent fractures during the postmenopausal years, with

relative-risk increases ranging from 1.5 to 3.0.[42] In addition, the prevalence of osteopenia and osteoporosis has been reported to be 15% and 0.6%, respectively, in premenopausal women.[43] Furthermore, it has been estimated that the loss of BMD ranges from 0.25% to 1% per year in premenopausal women.[42] While pharmacologic therapy is usually contraindicated in premenopausal women, reliance on lifestyle factors is almost always recommended.[42;44] One potentially effective lifestyle approach for achieving this goal is exercise, a low-cost, non-pharmacologic intervention that is available to the vast majority of the population. The purpose of this study was to use the aggregate data meta-analytic approach to determine the overall effects, as well as potential moderators and predictors of, ground and joint reaction force exercise on FN and LS BMD in premenopausal women.

A search of six electronic databases, cross-referencing from retrieved studies, hand searching selected journals, and expert review, resulted in 7 of 1,055 studies representing 17 groups (10 exercise, 7 control) and 521 participants (269 exercise, 252 control) that met the following inclusion criteria: (1) randomized trials with a comparative control group, (2) premenopausal women, (3) participants not engaged in a regular exercise program prior to study enrollment, (4) ground and/or joint reaction force exercise intervention of at least 24 weeks, (5) published and unpublished (master's theses and dissertations) studies since January 1989, and (6) data available for changes in BMD at the FN and/or LS and assessed using dual-energy X-ray absorptiometry (DEXA) or dual-photon absorptiometry (DPA). Any studies not meeting all six criteria were excluded.[45-51]

Using a random-effects model and standardized effect sizes (*g*) classified as either trivial (<0.20), small ($\geq$0.20 to <0.50), medium ($\geq$0.50 to <0.80), or large ($\geq$0.80),[38] statistically significant (p = 0.03) benefits with non-overlapping CI's were observed for FN BMD (Figure 3). Changes were equivalent to a 1.1% benefit (0.4% increase in the exercise groups, −0.7% decrease in the control groups). The NNT was 5.

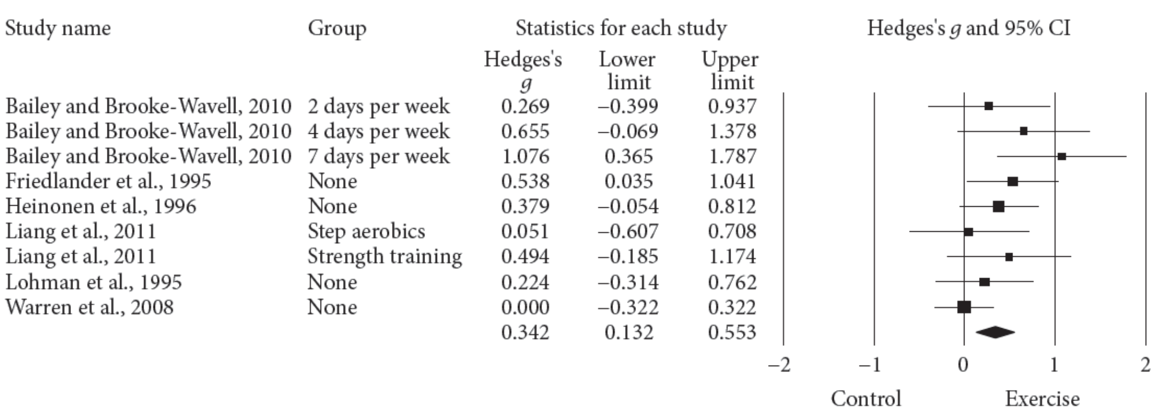


**Figure 3.** Forest plot for changes in FN BMD among premenopausal women. The black squares represent the standardized mean difference (g) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (g) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals.

There was a trend (p > 0.05 to $\leq$ 0.10) for greater benefits in FN BMD for those participating in home versus facility-based exercise. A statistically significant ( p $\leq$ 0.05) and positive relationship was observed between benefits in FN BMD and the number of sets

performed when resistance training while an inverse relationship was observed for exercise frequency. A trend for statistical significance was observed for greater benefits in FN BMD and (1) shorter exercise interventions, (2) lower initial FN BMD, (3) increases in body weight, and (4) decreases in upper body strength. Load rating was not associated with changes in FN BMD.

With one outlier deleted from the model, statistically significant benefits along with non-overlapping confidence intervals were observed between exercise and changes in LS BMD (Figure 4). The NNT was 9. A trend for a statistically significant association was observed for greater benefits in LS BMD and earlier published studies. No statistically significant association was found between load rating and changes in LS BMD.

| Study name | Group | Statistics for each study | | |
|---|---|---|---|---|
| | | Hedges's *g* | Lower limit | Upper limit |
| Friedlander et al., 1995 | None | 0.409 | −0.09 | 0.908 |
| Heinonen et al., 1996 | None | 0.323 | −0.109 | 0.754 |
| Liang et al., 2011 | Step aerobics | −0.035 | −0.693 | 0.622 |
| Liang et al., 2011 | Strength training | −0.183 | −0.854 | 0.488 |
| Lohman et al., 1995 | None | 0.381 | −0.16 | 0.921 |
| Warren et al., 2008 | None | 0.129 | −0.193 | 0.452 |
| | | 0.201 | 0.009 | 0.394 |

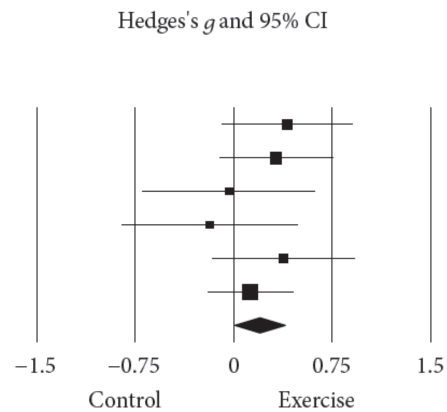


**Figure 4.** Forest plot for **c**hanges in LS BMD among premenopausal women. The black squares represent the standardized mean difference (g) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (g) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals.

The overall findings suggest that exercise results in small but statistically significant benefits in both FN and LS BMD. In addition, moderator analyses resulted in a trend for greater benefits on FN BMD when exercise took place in the home versus a facility. Since the investigative team is not aware of any consensus in the literature regarding which location is superior, future research in this area appears warranted.

Simple meta-regression analyses resulted in several noteworthy associations that may be appropriate for future investigation. Specifically, there was a trend for greater increases in FN BMD with shorter exercise interventions as well as a statistically significant association between increases in FN BMD and fewer days per week of exercise. One possible explanation for the negative associations observed may have to do with the loss of calcium from excessive exercise.[40;41] This causes a decrease in serum calcium, followed by an increase in serum parathyroid hormone, which then stimulates bone resorption.[40;41] However, no association was observed between changes in FN BMD and duration of training as well as exercise load rating. Thus, while these findings are interesting, further dose-response research is needed before any firm conclusions can be drawn. For resistance training, greater increases in FN BMD were associated with a greater number of sets. Since sweating as a result of resistance training is usually not as great as that from aerobic exercise, it may be that

a greater but undetermined amount of resistance training is needed to increase FN BMD in premenopausal women. However, no association was found between the number of exercises performed and changes in FN BMD. Given the former, it would appear appropriate to suggest that future dose-response studies are needed to address this issue. Until that time, it would appear plausible to suggest adherence to current exercise guidelines for optimizing BMD in adults.[12]

The trend for greater benefits in FN BMD and lower baseline BMD at the FN suggests that those with lower FN BMD may derive the greatest benefits as a result of exercise. This finning would seem to be entirely reasonable. The trend for increases in FN BMD to be associated with increases in body weight supports well-established research regarding greater BMD in heavier adult humans. Other than chance, the investigative team has no plausible explanation for the observed association between increases in FN BMD and smaller increases in upper body strength. Finally, there was a trend for greater benefits in LS BMD for those studies published during the earlier years. This observed association may be reflective of improved study designs in more recent years.

In conclusion, the overall findings of the current meta-analysis provide additional support regarding the benefits of exercise, including NNT estimates to aid decision makers regarding the utility of exercise for improving FN and LS BMD in premenopausal women. In addition, this study provides first-time meta-analytic evidence, when limited to randomized controlled trials, of potential moderators and predictors with respect to changes in FN and LS BMD which appears worthy of pursuing in future well-designed randomized controlled trials. The inability of the current meta-analysis to provide a definitive exercise prescription warrants further research.

**Details regarding the aforementioned study in premenopausal women can be found in the manuscript located in Appendix E, pages 306-321.**

**3. Exercise and BMD at the FN and LS in men.** While the prevalence of osteopenia and osteoporosis is more common in women than men,[52] the burden of this problem among men is still substantial. For example, recent data from the US National Center for Health Statistics reported that the age-adjusted prevalence of osteopenia among US men 50 years of age and older was 38% while the age-adjusted prevalence for osteoporosis was 4%.[52] Using 2010 population estimates from the US Census Bureau,[53] this means that approximately 16.8 million US men 50 years of age and older currently have osteopenia while more than 1.7 million have osteoporosis. One potential, low-cost, readily available non-pharmacologic approach for maintaining optimal BMD levels in men is exercise. The purpose of this study was to use the aggregate data meta-analytic approach to examine the effects of exercise on FN and LS BMD in men.

A search of six electronic databases, cross-referencing from retrieved studies, hand searching selected journals, and expert review resulted in 3 of 1,055 studies representing 9 groups (five exercise and four control) and 275 participants (152 exercise, 123 control) that met the following inclusion criteria: (1) randomized trials with a comparative control group, (2) men 18 years of age and older, (3) participants not taking part in regular exercise prior to study

enrollment, (4) ground and/or joint reaction force exercise intervention of at least 24 weeks, (5) published and unpublished (master's theses and dissertations) studies since January 1989, and (6) data available for changes in FN and/or LS BMD as assessed by dual-energy X-ray absorptiometry (DEXA) or dual-photon absorptiometry (DPA).

Using a random-effects model and standardized effect sizes (*g*) classified as either trivial (<0.20), small (≥0.20 to <0.50), medium (≥0.50 to <0.80), or large (≥0.80),[38] a statistically significant improvement was found at the FN (3 g's, 187 participants, g=0.583, p=0.04) (Figure 5). However, results were sensitive to influence analysis as well as collapsing multiple groups from the same studies so that only one *g* represented each study. Given the small sample size, we were unable to conduct any type of moderator or regression analyses.

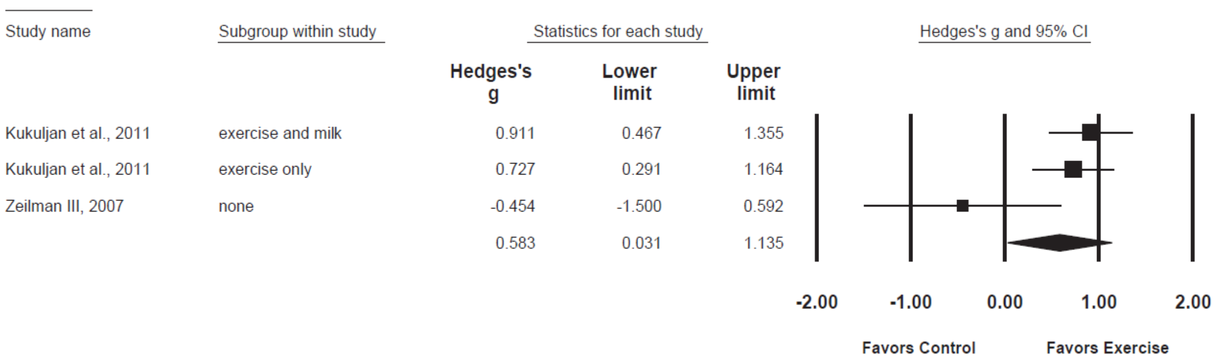


**Figure 5.** Forest plot for changes in FN BMD in men. The black squares represent the standardized mean difference (g) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (g) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals.

While not statistically significant, a trend for statistical significance was observed for exercise-induced benefits in LS BMD (5 g's, 275 participants, g=0.190, p=0.10) (Figure 6). However, results were sensitive to influence analysis as well as collapsing multiple groups from the same studies so that only one *g* represented each study. Similar to FN BMD, results were sensitive to influence analysis as well as collapsing multiple groups from the same studies so that only one *g* represented each study. We were unable to conduct any type of moderator or regression analyses because of the small sample size.

While a statistically significant benefit of exercise was observed in FN BMD and a trend in LS BMD, the findings for both were sensitive to influence analysis and/or collapsing multiple groups from the same study so that only one g represented each study. Thus, given the small number of g's included and the instability of results, it is believed that there is currently insufficient evidence to recommend exercise as a singular intervention for improving and/or maintaining FN and LS BMD in men. However, similar to recent clinical practice guidelines by the Endocrine Society on osteoporosis in men,[54] it is suggested that men, especially those at risk for osteoporosis, participate in regular exercise. While the Endocrine Society guidelines suggest that men participate in weight bearing, i.e., ground reaction force exercise, three to four times per week for 30 to 40 min per session, the American College of Sports Medicine Position Statement suggests that adults participate in

| Study name | Subgroup within study | Hedges's g | Lower limit | Upper limit |
|---|---|---|---|---|
| Hong, 2004 | tai chi | 0.267 | -0.246 | 0.780 |
| Hong, 2004 | weight training | 0.172 | -0.344 | 0.687 |
| Kukuljan et al., 2011 | exercise and milk | -0.088 | -0.511 | 0.334 |
| Kukuljan et al., 2011 | exercise only | 0.436 | 0.009 | 0.864 |
| Zeilman III, 2007 | none | 0.181 | -0.854 | 1.216 |
| | | 0.190 | -0.036 | 0.416 |

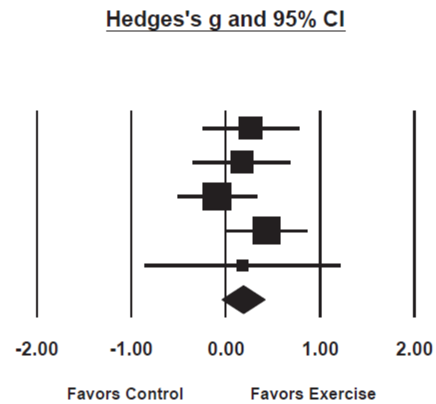


**Figure 6.** Forest plot for changes in LS BMD in men. The black squares represent the standardized mean difference (g) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (g) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals

ground reaction force exercise, i.e., weight bearing endurance exercise, 3 to 5 times per week for 30 to 60 min per session as well as joint reaction force exercise, i.e., weight training, 2 to 3 times per week.[12] Despite the current lack of convincing evidence to support the use of exercise for improving and/or maintaining FN and LS BMD in men, it would seem plausible that adherence to the latter would be more appropriate, especially given the other benefits and minimal risk derived from participation in both.[12;55] Finally, it is clear that additional randomized controlled trials addressing the effects of exercise on FN and LS BMD in men are needed. This recommendation is consistent with the 2008 US Department of Health and Human Services Physical Activity Guidelines for Americans.[11]

In conclusion, there is currently insufficient evidence at this time to recommend ground and/or joint reaction force exercise for improving and/or maintaining FN and LS BMD in men. Additional well-designed randomized controlled trials in men are needed before any final recommendations can be formulated.

**Details regarding the aforementioned study in men can be found in the manuscript located in Appendix E, pages 322-330.**

## III. KEY RESEARCH ACCOMPLISHMENTS FOR PROJECT PERIOD

A. Developed an electronic search strategy for potentially eligible studies (Appendix A).
B. Developed a reference database of intervention studies dealing with the effects of exercise on FN and LS BMD in adults (Appendix B).
C. Developed code book and coded data for all eligible intervention studies dealing with the effects of exercise on FN and LS BMD in adults (Appendix C).
D. Published and presented three abstracts dealing with the effects of exercise intervention studies on FN and LS BMD in adults (Appendix D).
E. Published three meta-analytic papers dealing with the effects of exercise intervention studies on FN and LS BMD in adults (Appendix E).

## IV. REPORTABLE OUTCOMES FOR PROJECT PERIOD

### A. Published Abstracts of Presentations (Appendix D)

1. **Kelley G**, Kelley K, Kohrt W. (2012). Effects of ground and joint reaction force exercise on lumbar spine and femoral neck bone mineral density in postmenopausal women: a meta-analysis of randomized controlled trials. Arthritis and Rheumatism. 64(10):S1014-S1015. (Pages 281-282 of Appendix)

2. **Kelley GA**, Kelley KS, Kohrt WM. (2013) Exercise and bone mineral density in premenopausal women: A meta-analysis of randomized controlled trials. Medicine and Science in Sports and Exercise. 1206. (Pages 283-284 of Appendix)

3. **Kelley GA**, Kelley KS, Kohrt WM. (2013) Exercise and bone mineral density in men: A meta-analysis of randomized controlled trials. Medicine and Science in Sports and Exercise. 1599. (Page 285 of Appendix)

### B. Articles Published (Appendix E)

1. **Kelley G**, Kelley K, Kohrt W. (2012). Effects of ground and joint reaction force exercise on lumbar spine and femoral neck bone mineral density in postmenopausal women: a meta-analysis of randomized controlled trials. BMC Musculoskeletal Disorders. 13(1): Article ID 177, 1-19. (Pages 287-305 of Appendix)

2. **Kelley GA**, Kelley KS, Kohrt WM. Exercise and bone mineral density in premenopausal women: A meta-analysis of randomized controlled trials. International Journal of Endocrinology 2013, Article ID 741639, 1-16. 201. (Pages 306-321 of Appendix)

3. **Kelley GA,** Kelley KS, Kohrt WM. Exercise and bone mineral density in men: A meta- of randomized controlled trials. Bone. 53:103-111. (Pages 322-330 of Appendix)

### C. Personnel (Paid)

1. Dr. George A. Kelley, FACSM – Principal Investigator
2. Kristi Sharpe-Kelley, M.Ed. – Research Technician
3. Dr. Wendy Kohrt – Consultant

## V. CONCLUSIONS FOR PROJECT PERIOD

### A. Implications of Completed Research

The overall results of our research led us to the following major conclusions:

1. Exercise increases and maintains FN and LS BMD in postmenopausal women.
2. Exercise increases and maintains FN and LS BMD in premenopausal women.
3. While promising, there is currently insufficient evidence to recommend exercise as being beneficial for FN and LS BMD in men.

4. Weight-bearing endurance activities 3 to 5 times per week as well as resistance exercise 2 to 3 times per week should benefit FN and LS BMD.[12]

## B. Suggestions for Future Research

Based on our findings, we recommend the following areas in which additional research is needed:

1. Additional randomized controlled trials addressing the dose-response effects of exercise on FN and LS BMD in adult men and women of all ages.
2. Additional randomized controlled trials addressing the overall effects of exercise on FN and LS BMD in men.
3. The development of more valid and reliable load rating instruments that can easily be applied in randomized controlled exercise intervention trials.

## B. So What?

Osteoporosis and osteopenia are major public health problems among both men and women. The results of our research suggest that exercise can benefit FN and LS BMD in pre and postmenopausal women. These benefits may reduce the risk for subsequent fracture.

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## VII. APPENDICES

A. Search Strategies for Electronic Database Searches
B. Reference Lists of Included and Excluded BMD Studies
C. Base Meta-Analytic Codebook
D. Published Abstracts of Presentations at Professional Conferences
E. Publications in Peer-Reviewed Biomedical Journals

**APPENDIX A**
**Database Search Strategies**

## 1. Medline

# Query Limiters/Expanders Last Run Via Results
S7 (s3 and s6) Limiters - Date of Publication from: 19890101-20100631; Human; Age Related: All Adult: 19+ years
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - MEDLINE 402
S6 (s4 or s5) Limiters - Date of Publication from: 19890101-20100631; Human; Age Related: All Adult: 19+ years
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - MEDLINE 387298
S5 TX clinical w1 trial* Limiters - Date of Publication from: 19890101-20100631; Human; Age Related: All Adult: 19+ years
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - MEDLINE 324417
S4 TX random* w1 control* Limiters - Date of Publication from: 19890101-20100631; Human; Age Related: All Adult: 19+ years
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - MEDLINE 211688
S3 (s1 and s2) Limiters - Date of Publication from: 19890101-20100631; Human; Age Related: All Adult: 19+ years
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - MEDLINE 1672
S2 (MH "bone density") or TX bone w1 densit* Limiters - Date of Publication from: 19890101-20100631; Human; Age Related: All Adult: 19+ years
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - MEDLINE 21414
S1 MH exercise or TX exercise Limiters - Date of Publication from: 19890101-20100631; Human; Age Related: All Adult: 19+ years
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - MEDLINE 82574

**2. Cochrane Database of Controlled Clinical Trials**

(exercise):ti,ab,kw and (bone NEAR/1 densit*):ti,ab,kw and (random* NEAR/1 control*):ti,ab,kw and (human):ti,ab,kw, from 1989 to 2010 in Clinical Trials

**3. Dissertation Abstracts Online**

(kw: exercise and kw: bone and kw: densit*) and kw: random*
years 1989-2010

**4. Embase**

| Set | Items | Description |
|---|---|---|
| S1 | 224518 | EXERCISE OR EXERCISE/DE |
| S2 | 41847 | BONE(W)DENSIT? OR BONE(W)DENSITY/DE |
| S3 | 2630 | S1 AND S2 |
| S4 | 294309 | RANDOM?(W)CONTROL? |
| S5 | 868757 | CLINICAL(W)TRIAL? |
| S6 | 894597 | S4 OR S5 |
| S7 | 585 | S3 AND S6 |
| S8 | 578 | S7/HUMAN |
| S9 | 577 | S8 AND PY=1989:2010 |
| S10 | 296 | S9 AND DT=ARTICLE |
| S11 | 296 | S10 NOT DT=EDITORIAL |
| S13 | 54 | FS=MEDLINE AND S11 |

**5. CINAHL**

# Query Limiters/Expanders Last Run Via Results
S7 (s3 and s6) Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - CINAHL with Full Text 224
S6 (s4 or s5) Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - CINAHL with Full Text 41070
S5 (MH "Clinical Trials+") Limiters - Published Date from: 19890101-20100631; Human; Age Groups: All Adult
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - CINAHL with Full Text 35755
S4 TX random* w1 control* Limiters - Published Date from: 19890101-20100631; Human; Age Groups: All Adult
Search modes - Find all my search terms Interface - EBSCOhost

Search Screen - Advanced Search
Database - CINAHL with Full Text 13913
S3 (s1 and s2) Limiters - Published Date from: 19890101-20100631; Human; Age Groups: All Adult
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - CINAHL with Full Text 672
S2 (NH "bone density") or TX bone w1 densit* Limiters - Published Date from: 19890101-20100631; Human; Age Groups: All Adult
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - CINAHL with Full Text 2392
S1 MH exercise or TX exercise Limiters - Published Date from: 19890101-20100631; Human; Age Groups: All Adult
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - CINAHL with Full Text 29586

**6. SportDiscus**

# Query Limiters/Expanders Last Run Via Results
S11 (s7 and s10) Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text 300
S10 (s8 or s9) Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text 135179
S9 (teenager* or adolescen* or teen* or adult or senior or aged or geriatric or geriatrics or elder or elderly) Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text 84621
S8 human Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text 59183
S7 (s3 and s6) Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text 639
S6 (s4 or s5) Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search

Database - SPORTDiscus with Full Text 23853
S5 TX clinical w1 trial* Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text 16823
S4 TX random* w1 control* Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text 13437
S3 (s1 and s2) Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text Display
S2 (MH "bone density") or TX bone w1 densit* Limiters - Published Date: 19890101-20100631
Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text Display
S1 TX exercise or MH exercise Limiters - Published Date: 19890101-20100631

Search modes - Find all my search terms Interface - EBSCOhost
Search Screen - Advanced Search
Database - SPORTDiscus with Full Text Display

# APPENDIX B
## Included and Excluded BMD Studies

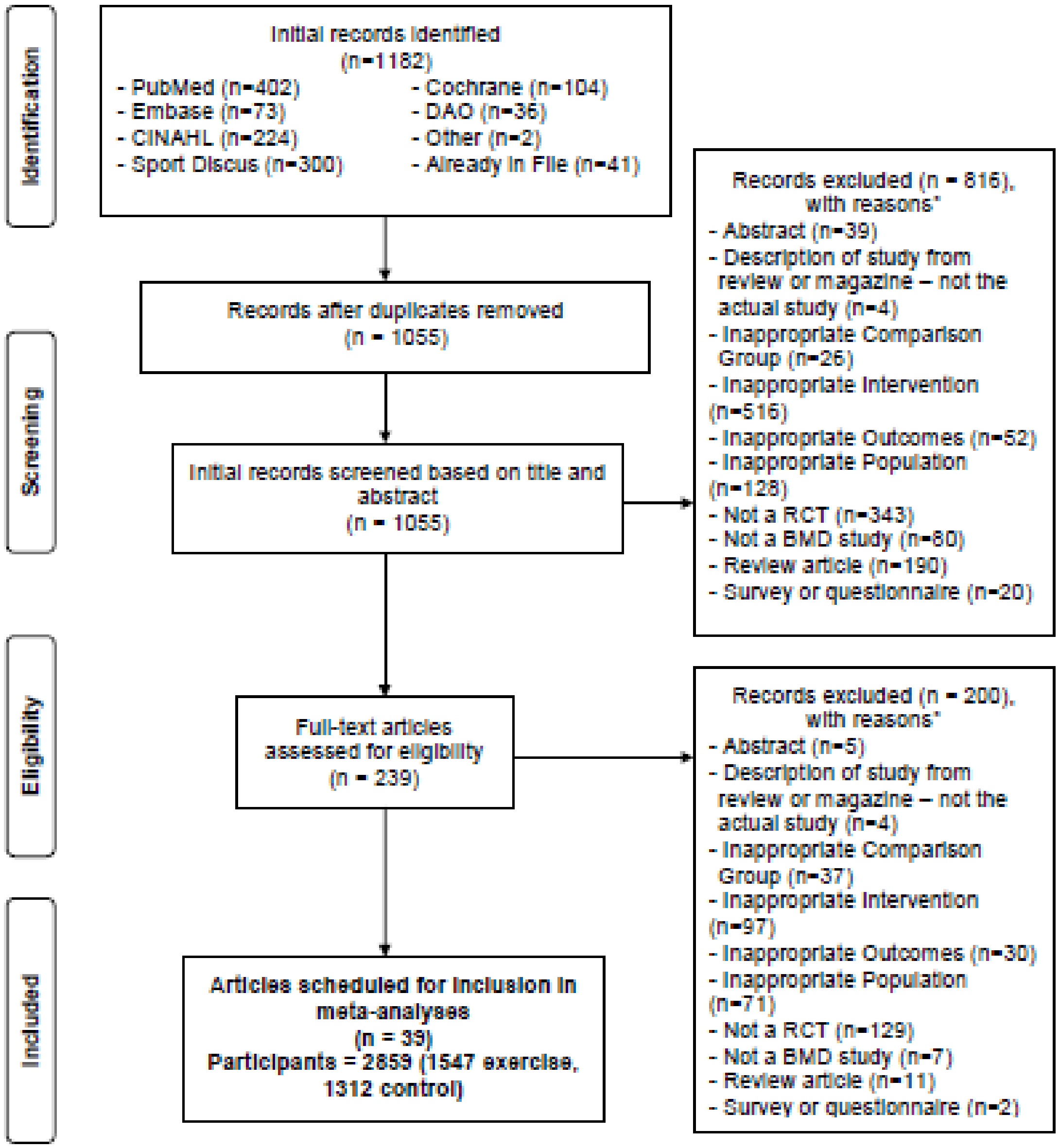


Figure 1. Flow diagram for selection of articles. *, number of reasons exceeds the number of articles because some articles were excluded for more than one reason.

1. **Included Studies (n = 39)**


(1) Bailey CA, Brooke-Wavell K. Optimum frequency of exercise for bone health: Randomised controlled trial of a high-impact unilateral intervention. Bone 2010;46(4):1043-9.

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## 2. Excluded Studies, with Reasons (n =1016)

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(8) Current literature. Journal of Human Nutrition & Dietetics 2002 October;15(5):399-415. Abstract

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(46) Proceedings of SRR. Clinical Rehabilitation 2008 September;22(9):856-63. Abstract

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# APPENDIX C
# Codebooks for Meta-Analyses

Study Characterisics

| study_id1_new | author | source | year | journal | language | language_other | country | country_2 | design | type_c |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Bailey & Brooke-Wavell | journal | 2010 | Bone | english | | United Kingdom | other | rct | other |
| 302 | Bassey et al. | journal | 1998 | J Bone Miner Res | english | | United Kingdom | other | rct | nonintervention |
| 298 | Bergstrom et al. | journal | 2008 | Osteoporos Int | english | | Sweden | other | rct | other |
| 1057 | Bergstrom et al. | journal | 2005 | Osteoporos Int | english | | Sweden | other | rct | other |
| 744 | Bocalini et al. | journal | 2009 | J Aging Health | english | | Brazil | other | rct | nonintervention |
| 1170 | Brentano et al. | journal | 2008 | J Strength Cond Res | english | | Brazil | other | rct | nonintervention |
| 26 | Brooke-Wavell et al. | journal | 1997 | Clin Sci | english | | United Kingdom | other | rct | other |
| 362 | Chilibeck et al. | journal | 2002 | Can J Physiol Pharmacol | english | | Canada | other | rct | other |
| 1085 | Choquette et al. | journal | 2011 | Br J Nutr | english | | Canada | other | rct | other |
| 405 | Englund et al. | journal | 2005 | Osteoporos Int | english | | Sweden | other | rct | nonintervention |
| 407 | Friedlander et al. | journal | 1995 | J Bone Miner Res | english | | United States | usa | rct | attention control |
| 161 | Going et al. | journal | 2003 | Osteoporos Int | english | | United States | usa | rct | nonintervention |
| 71 | Grove & Londeree/Grove | journal | 1992 | Med Sci Sports Exerc | english | | United States | usa | rct | nonintervention |
| 21 | Heinonen et al. | journal | 1996 | Lancet | english | | Finland | other | rct | nonintervention |
| 951 | Heinonen et al. | journal | 1998 | J Bone Miner Res | english | | Finland | other | rct | attention control |
| 1019 | Hong | dissertation | 2004 | The Chinese University of Hong Kong | english | | China | other | rct | nonintervention |
| 135 | Iwamoto et al. | journal | 2001 | J Orthop Sci | english | | Japan | other | rct | other |
| 819 | Jessup et al. | journal | 2003 | Biol Res Nurs | english | | United States | usa | rct | other |
| 827 | Kemmler et al. | journal | 2010 | Arch Intern Med | english | | Germany | other | rct | attention control |
| 205 | Kerr et al. | journal | 1996 | J Bone Miner Res | english | | Australia | other | rct | other |
| 322 | Kerr et al. | journal | 2001 | J Bone Miner Res | english | | Australia | other | rct | other |
| 1113 | Kukuljan et al. | journal | 2011 | J Clin Endocrinol Metab | english | | Australia | other | rct | nonintervention |
| 1118 | Liang et al. | journal | 2011 | Int J Sports Med | english | | United States | usa | rct | nonintervention |
| 85 | Liu-Ambrose et al. | journal | 2004 | J Clin Densitom | english | | Canada | other | rct | attention control |
| 184 | Lohman et al. | journal | 1995 | J Bone Miner Res | english | | United States | usa | rct | nonintervention |
| 1120 | Marques et al. | journal | 2011 | Exp Gerontol | english | | Portugal | other | rct | nonintervention |
| 1121 | Marques et al. | journal | 2011 | Calcif Tissue Int | english | | Portugal | other | rct | nonintervention |
| 19 | Martin & Notelovitz | journal | 1993 | J Bone Miner Res | english | | United States | usa | rct | other |
| 170 | Nelson et al. | journal | 1994 | JAMA | english | | United States | usa | rct | nonintervention |
| 863 | Newstead et al. | journal | 2004 | J Geriatr Phys Ther | english | | United States | usa | rct | other |
| 365 | Prince et al. | journal | 1995 | J Bone Miner Res | english | | Australia | other | rct | other |
| 174 | Rhodes et al. | journal | 2000 | Br J Sports Med | english | | Canada | other | rct | nonintervention |
| 30 | Villareal et al. | journal | 2011 | N Engl J Med | english | | United States | usa | rct | other |
| 913 | Villareal et al. | journal | 2004 | Age Ageing | english | | United States | usa | rct | other |
| 920 | Warren et al. | journal | 2008 | Med Sci Sports Exerc | english | | United States | usa | rct | usual care |
| 239 | Weaver et al. | journal | 2001 | Med Sci Sports Exerc | english | | United States | usa | rct | nonintervention |
| 922 | Westby et al. | journal | 2000 | J Rheumatol | english | | Canada | other | rct | other |
| 105 | Wu et al. | journal | 2006 | Metabolism | english | | Japan | other | rct | other |
| 930 | Zeilman III | dissertation | 2007 | Univ. of Florida | english | | United States | usa | rct | other |

Study Characterisics

| type_c_desc | matching |
|---|---|
| control group included but also had a control leg (unilateral training) | no |
| | no |
| control & ex groups both received calcium & Vitamin D supplements | no |
| control & ex groups both received calcium supplements | no |
| asked to maintain their normal daily activity routines | no |
| asked to keep the same activities during the period of 24 weeks | yes |
| Nine women in control group exercised option of swimming 2x week for 20 minutes | no |
| placebo | no |
| control and exercise groups received a placebo (cellulose) | no |
| control subjects asked not to increase their physical activity during the study | yes |
| given the option to continue with current level of PA or attend 2 out of 3, 30 minute stretching classes/wk | no |
| | yes |
| | yes |
| asked to maintain their current level of physical activity | yes |
| Light stretching exercises once a week (Sham exercise) | no |
| | yes |
| control & ex groups both received calcium & Vitamin D supplements | no |
| subjects received 1000 mg of calcium and 400 IU vitamin D per day (same as exercise group) | no |
| low-frequency, low intensity (50%-60% mhr) activity for 60 minutes, 1x per week for 10 weeks followed by 10 weeks of rest | yes |
| alternate limb served as the control | no |
| all subjects received 600 mg elemental calcium per day | no |
| | yes |
| required to submit weekly physical activity logs | no |
| sham exercise (stretching) | yes |
| subjects asked to maintain their normal daily routine | no |
| continue their daily routine and refrain from changing physical activity levels | no |
| asked to continue their daily routines and not to change physical activity levels during the course of the experiment | no |
| subject's received the same calcium supplementation as the exercise group | no |
| asked to maintain their current level of physical activity | no |
| control & ex groups both received calcium supplements | no |
| subject's received the same calcium supplementation (tablets) as the exercise group | no |
| instructed to maintain their normal lifestyle throughout the study; offered training program after the study | no |
| provided general information about a healthy diet during monthly visits with staff | yes |
| control group did exercises for flexibility, balance and coordination 2.9 +- 1.5 days/wk; all subjects received calcium & Vit D supplements | no |
| received AHA brochure recommending 30 minutes of moderate intensity activity on most days of the week | no |
| | yes |
| usual care + written materials on osteoporosis & pamphlet on ex & arthritis | no |
| placebo (2 capsules of dextrin, daily in the morning) | no |
| both groups took 1200 mg calcium and 400 IU Vitamin D every day; asked to continue ADL and to not start exercising | no |

Study Characterisics

| matching_des | crossover | sequence | allocation | blind_prime | inc_prime | outcome_rep | analysis | sample_size | groups_e |
|---|---|---|---|---|---|---|---|---|---|
| | no | yes | unclear | yes | unclear | unclear | abp | yes | 3 |
| | no | yes | unclear | yes | unclear | unclear | abp | yes | 3 |
| | no | yes | unclear | no | yes | no | abp & itt | yes | 1 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 1 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 1 |
| subjects divided by hrt use (yes versus no) and then randomly assigned to groups | no | yes | unclear | yes | unclear | unclear | abp | yes | 2 |
| | no | yes | unclear | yes | yes | unclear | abp | no | 1 |
| | no | yes | unclear | yes | unclear | unclear | abp | yes | 1 |
| | no | yes | unclear | yes | unclear | yes | abp | no | 1 |
| age | no | yes | unclear | yes | yes | unclear | abp | yes | 1 |
| | no | yes | yes | yes | yes | unclear | abp | no | 1 |
| hrt | no | yes | unclear | yes | unclear | unclear | abp | no | 2 |
| bmd, bodyweight | no | yes | unclear | yes | yes | unclear | abp | no | 2 |
| weight, oral contraceptive use | no | yes | unclear | yes | yes | unclear | itt | yes | 1 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 2 |
| gender | no | yes | unclear | yes | yes | unclear | abp | yes | 4 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 1 |
| | no | yes | unclear | yes | yes | unclear | abp | yes | 1 |
| age | no | yes | unclear | yes | yes | yes | abp & itt | yes | 1 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 2 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 2 |
| age, calcium intake | no | yes | unclear | yes | yes | unclear | itt | yes | 2 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 2 |
| postural stability, baseline total hip areal BMD, bisphosphonate use | no | yes | unclear | yes | yes | unclear | abp | yes | 2 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 1 |
| | no | yes | unclear | yes | yes | unclear | itt | yes | 2 |
| | no | yes | unclear | yes | yes | unclear | abp & itt | yes | 1 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 2 |
| | no | yes | unclear | yes | yes | unclear | itt | no | 1 |
| | no | yes | unclear | yes | yes | unclear | abp | yes | 1 |
| | no | yes | yes | yes | unclear | unclear | abp | no | 1 |
| | no | yes | unclear | yes | unclear | unclear | abp | no | 1 |
| gender | no | yes | unclear | yes | yes | unclear | itt | yes | 1 |
| | no | yes | unclear | yes | yes | unclear | itt | yes | 1 |
| | no | yes | unclear | yes | yes | unclear | itt | yes | 1 |
| age, oral contraceptive use | no | yes | unclear | yes | unclear | unclear | abp | no | 1 |
| | no | yes | unclear | yes | yes | unclear | itt | yes | 1 |
| | no | yes | unclear | yes | yes | unclear | abp | no | 1 |
| | no | yes | unclear | yes | yes | unclear | abp | yes | 1 |

Study Characterisics

| groups_c | groups_t | funded | notes_sc |
|---|---|---|---|
| 1 | 4 | no | |
| 3 | 6 | yes | Postmenopasual women with BMD <2.0 SD or any woman with BMD >1.5 SD excluded |
| 1 | 2 | no | all participants has a previous forearm fracture |
| 1 | 2 | no | all participants were perimenopausal |
| 1 | 2 | no | postmenopasual participants not taking hormone replacement therapy |
| 1 | 3 | no | |
| 1 | 2 | yes | |
| 1 | 2 | yes | |
| 1 | 2 | yes | all participants were overweight, postmenopausal women; study also included an exercise and isoflavone and isoflavone only group |
| 1 | 2 | yes | |
| 1 | 2 | yes | exercise + calcium and exercise + placebo combined; control + calcium and control + placebo combined |
| 2 | 4 | yes | exercise & control group on HRT; exercise & control group not on HRT; all subjects received 800 mg calcium citrate supplements daily |
| 1 | 3 | no | |
| 1 | 2 | yes | |
| 1 | 3 | yes | |
| 2 | 6 | yes | |
| 1 | 2 | no | all participants given 2 grams of calcium and 1 microgram of vtaimin D3 each day |
| 1 | 2 | yes | all participants received 1000 mg of calcium and 400 IU vitamin D per day |
| 1 | 2 | yes | all participants received 1500 mg of calcium and 500 IU of cholecalciferol (vitamin D) per day |
| 2 | 4 | yes | |
| 1 | 3 | yes | |
| 2 | 4 | yes | exercise and milk versus milk only group included as well as an exercise only versus control group |
| 1 | 3 | yes | |
| 1 | 3 | yes | |
| 1 | 2 | no | |
| 1 | 3 | yes | |
| 1 | 2 | yes | both itt and abp analysis done but data not reported for abp analysis |
| 1 | 3 | yes | subjects in both exercise and control groups were given 1000 mg/d of supplemental calcium |
| 1 | 2 | yes | |
| 1 | 2 | yes | |
| 1 | 2 | yes | subjects in both exercise and control groups were given 1000 mg/d of supplemental calcium |
| 1 | 2 | no | |
| 1 | 2 | yes | all participants received 1500 mg of calcium and 1000 IU of vitamin D per day; limited to obese participants |
| 1 | 2 | yes | subjects were frail elderly participants 78 years of age and older; partial itt |
| 1 | 2 | yes | |
| 1 | 2 | yes | results poorly reported; same study as id# 202 that we chose not to code |
| 1 | 2 | yes | all participants received 1000 mg of calcium and 400 IU vitamin D per day; partial itt |
| 1 | 2 | yes | exercise subjects also received placebo (2 capsules of dextrin daily, in the morning) |
| 1 | 2 | no | all subjects had inflammatory bowel disease |

Group Characteristics

| study_id2_new | author2 | group_id1 | group_desc | i_n_e | f_n_e | drop_e |
|---|---|---|---|---|---|---|
| 2 | Bailey & Brooke-Wavell | 1 | 2 days per week | 21 | 16 | 24 |
| 2 | Bailey & Brooke-Wavell | 2 | 4 days per week | 22 | 13 | 41 |
| 2 | Bailey & Brooke-Wavell | 3 | 7 days per week | 22 | 16 | 27 |
| 302 | Bassey et al. | 1 | premenopausal | | 30 | |
| 302 | Bassey et al. | 2 | postmenopausal | | 45 | |
| 302 | Bassey et al. | 3 | postmenopausal-hrt | | 24 | |
| 298 | Bergstrom et al. | 1 | | 60 | 48 | 20 |
| 1057 | Bergstrom et al. | 1 | | 20 | 12 | 40 |
| 744 | Bocalini et al. | 1 | | 23 | 15 | 35 |
| 1170 | Brentano et al. | 1 | strength training | | 9 | |
| 1170 | Brentano et al. | 2 | circuit training | | 10 | |
| 26 | Brooke-Wavell et al. | 1 | | 43 | 39 | 9 |
| 362 | Chilibeck et al. | 1 | | 14 | 10 | 29 |
| 1085 | Choquette et al. | 1 | | 25 | 18 | 28 |
| 405 | Englund et al. | 1 | | 24 | 21 | 13 |
| 407 | Friedlander et al. | 1 | | | 32 | 50 |
| 161 | Going et al. | 1 | hrt | 86 | 71 | 17 |
| 161 | Going et al. | 2 | no hrt | 91 | 71 | 22 |
| 71 | Grove & Londeree/Grove | 1 | low impact | 5 | 5 | 0 |
| 71 | Grove & Londeree/Grove | 2 | high impact | 5 | 5 | 0 |
| 21 | Heinonen et al. | 1 | | 49 | 39 | 20 |
| 951 | Heinonen et al. | 1 | calisthenics | 35 | 26 | 26 |
| 951 | Heinonen et al. | 2 | endurance | 32 | 23 | 28 |
| 1019 | Hong | 1 | tai chi-men | 30 | 30 | 0 |
| 1019 | Hong | 2 | weight training-men | 30 | 29 | 3 |
| 1019 | Hong | 3 | tai chi-women | 30 | 28 | 7 |
| 1019 | Hong | 4 | weight training-women | 30 | 30 | 0 |
| 135 | Iwamoto et al. | 1 | | | 8 | |
| 819 | Jessup et al. | 1 | | 10 | 9 | 10 |
| 827 | Kemmler et al. | 1 | | 123 | 115 | 7 |
| 205 | Kerr et al. | 1 | weight training (high load, low reps) | 28 | 25 | 11 |
| 205 | Kerr et al. | 2 | weight training (low load, high reps) | 28 | 21 | 25 |
| 322 | Kerr et al. | 1 | weight training | 42 | 24 | 43 |
| 322 | Kerr et al. | 2 | circuit training | 42 | 30 | 29 |
| 1113 | Kukuljan et al. | 1 | exercise and milk | 45 | 43 | 4 |
| 1113 | Kukuljan et al. | 2 | exercise only | 46 | 44 | 4 |
| 1118 | Liang et al. | 1 | strength training | 30 | 15 | 50 |
| 1118 | Liang et al. | 2 | step aerobics | 32 | 16 | 50 |
| 85 | Liu-Ambrose et al. | 1 | weight training | 34 | 32 | 6 |

Group Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| 85 | Liu-Ambrose et al. | 2 | agility training | 36 | 34 | 6 |
| 184 | Lohman et al. | 1 | | 59 | 22 | 63 |
| 1120 | Marques et al. | 1 | resistance training | 23 | 15 | 35 |
| 1120 | Marques et al. | 2 | aerobic training | 24 | 19 | 21 |
| 1121 | Marques et al. | 1 | | 30 | 27 | 10 |
| 19 | Martin & Notelovitz | 1 | 30 minutes | 27 | 20 | 26 |
| 19 | Martin & Notelovitz | 2 | 45 minutes | 25 | 16 | 36 |
| 170 | Nelson et al. | 1 | | 21 | 20 | 5 |
| 863 | Newstead et al. | 1 | | 25 | 23 | 8 |
| 365 | Prince et al. | 1 | exercise and calcium | 42 | 31 | 26 |
| 174 | Rhodes et al. | 1 | | 22 | 20 | 9 |
| 30 | Villareal et al. | 1 | | 26 | 22 | 15 |
| 913 | Villareal et al. | 1 | | 69 | 42 | 39 |
| 920 | Warren et al. | 1 | | 72 | 62 | 14 |
| 239 | Weaver et al. | 1 | | 77 | 28 | 64 |
| 922 | Westby et al. | 1 | | 14 | 11 | 21 |
| 105 | Wu et al. | 1 | | 34 | 31 | 9 |
| 930 | Zeilman III | 1 | | 8 | 7 | 13 |

Group Characteristics

| reason_e | adverse_e |
|---|---|
| changed circumstance (3); time constraints (1); ankle sprain (1) | |
| changed circumstance (2); time constraints (2); personal reasons (1); lower limb discomfort(1); recurrence of back pain (1); injury unrelated to exercise (2) | |
| time constraints (1); lower limb discomfort (3); lower back discomfort (2) | |
| | |
| | no |
| | no |
| DEXA during HRT (1); inadequate level of training (11), related to intervention | |
| vaginal bleeding (1); infection (1); knee problems (1); myoma surgery (1); myocardial infarction (1); needed hrt (2); personal resasons (1) | |
| compliance to exercise less than 90% (5) | |
| | |
| | |
| surgery (1); illness/bereavement (2); fall at home (1); hyperthyroidism (1) | |
| time (4) | |
| | no |
| dementia(1);heart failure(1);unspecified knee pain(1) | |
| nd (reasons reported but not separately for exercise and control groups), unrelated to intervention | |
| | |
| | |
| | no |
| one person injured at 11 months and all but treadmill data collected at post | yes |
| previous musculoskeletal problems (2); lower-limb overuse injury (2); pregnancy (1); moved (2); lost interest (3), all unrelated to study protocol | no |
| moved (1); overuse injury (1); lost interest (7) | no |
| overuse injury (1); lost interest (8) | no |
| | |
| | |
| | |
| | |
| | |
| | no |
| | no |
| | no |
| | no |
| | |
| | yes |
| time (1); illness (1) | no |
| time (1); illness (1) | no |
| dropouts (10); noncompliance (5) | |
| dropouts (10); noncompliance (6) | |
| time commitment (1); ill health (1) | no |

Group Characteristics

| | |
|---|---|
| time commitment (2) | no |
| | |
| medical issues unrelated to intervention (3); disinterest (3); personal reasons (2) | no |
| medical issues unrelated to intervention (2); personal reasons (3) | no |
| medical problems unrelated to intervention (2); personal reasons (1) | no |
| | |
| | |
| myocardial infarction while on vacation (1), unrelated to intervention | no |
| time and/or moved; injury (1) | yes |
| | |
| | no |
| wanted to lose weight (1); job (1); family (1); medical (1) | yes |
| personal (3); medical problems (17) | |
| additional participants were excluded because they became pregnant or started corticosteroid use | |
| nd (reasons reported but not separately for exercise and control groups) | |
| | |
| family problems (1); illness (1); other (1) | |
| moved (1) | |

Group Characteristics

| adverse_desc |
| --- |
| |
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| |
| some exacerbation of unreported problems with bunions or knee pain (n=3) |
| some exacerbation of unreported problems with bunions or knee pain (n=3) |
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| |
| injured at 11 months (1) |
| mild ankle distortion(1); knee-overuse injuries(4); Achilles-tendon inflammation(1); unspecified foot pain(1); aggravated low back pains (8); partial calf muscle rupture(1) |
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| |
| pre-existing back & shoulder injury (2), developed wrist injury (1) |
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| |

Group Characteristics

| |
|---|
| |
| |
| no |
| no |
| |
| |
| |
| transient musculoskeletal pain that required minor modifications to the training program (7) |
| knee problems (1) |
| |
| |
| back pain (2); tendon tear and tendonitis (1); ankle fracture (1); hematoma (1); transient atrial fibrillation during exercise (1) |
| |
| |
| |
| |
| |
| |

Group Characteristics

| i_n_c | f_n_c | drop_c | reason_c | i_n_t | f_n_t | gender |
|---|---|---|---|---|---|---|
| 20 | 19 | 5 | changed circumstances (1) | 41 | 35 | females |
| | | | | 22 | 13 | females |
| | | | | 22 | 16 | females |
| | 25 | | | | 55 | females |
| | 32 | | | | 77 | females |
| | 22 | | | | 46 | females |
| 52 | 44 | 15 | started too extensive training (8) | 112 | 92 | females |
| 20 | 15 | 25 | personal reasons (3); needed hrt (2) | 40 | 27 | females |
| 12 | 10 | 17 | | 35 | 25 | females |
| | 9 | | | | 18 | females |
| | | | | | 10 | females |
| 41 | 40 | 2 | surgery (1) | 84 | 79 | females |
| 14 | 12 | 14 | hysterectomy and hrt (1); hrt (1) | 28 | 22 | females |
| 26 | 22 | 15 | | 51 | 40 | females |
| 24 | 19 | 21 | lack of interest (2); death (1); started exercise (2) | 48 | 40 | females |
| | 31 | 50 | nd (reasons reported but not separately for exercise and control groups) | | 63 | females |
| 73 | 65 | 11 | | 159 | 136 | females |
| 70 | 59 | 16 | | 161 | 130 | females |
| 6 | 5 | 17 | | 11 | 10 | females |
| | | | | | | females |
| 49 | 45 | 8 | accidental back injury (1); moved (1); lost interest (2) | 98 | 84 | females |
| 34 | 27 | 21 | died from cancer (1); lost interest (6) | 69 | 53 | females |
| | | | | 32 | 23 | females |
| 30 | 29 | 3 | | 60 | 59 | males |
| | | | | 30 | 29 | males |
| 30 | 30 | 0 | | 60 | 58 | females |
| | | | | 30 | 30 | females |
| | 20 | | | | 28 | females |
| 10 | 9 | 10 | | 20 | 18 | females |
| 123 | 112 | 9 | | 246 | 227 | females |
| 28 | 25 | 11 | | 28 | 25 | females |
| 28 | 21 | 25 | | 28 | 21 | females |
| 42 | 36 | 14 | | 84 | 60 | females |
| | | | | 42 | 30 | females |
| 45 | 43 | 4 | time (2) | 90 | 86 | males |
| 44 | 42 | 5 | time (1); unsatisfied (1) | 90 | 86 | males |
| 28 | 20 | 29 | dropouts (8) | 58 | 35 | females |
| | | | | 32 | 16 | females |
| 34 | 32 | 6 | time commitment (1); ill (1) | 68 | 64 | females |

Group Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | 36 | 34 | females |
| 47 | 34 | 28 | | 106 | 56 | females |
| 24 | 20 | 17 | surgery (1); unwilling to participate as control (2); personal reasons (1) | 47 | 35 | females |
| | | | | 24 | 19 | females |
| 30 | 22 | 27 | surgery (2); unwilling to particpate as control (3); personal reasons (3) | 60 | 49 | females |
| 24 | 19 | 21 | | 51 | 39 | females |
| 24 | | | | 49 | 16 | females |
| 19 | 19 | 0 | no dropouts | 40 | 39 | females |
| 28 | 26 | 7 | time and or moved | 53 | 49 | females |
| 42 | 35 | 17 | | 84 | 66 | females |
| 22 | 18 | 18 | refused to participate or unavailable for testing (4) | 44 | 38 | females |
| 27 | 23 | 15 | lacked interest (3); medical reasons (1) | 53 | 45 | mixed |
| 50 | 38 | 24 | death (1); personal (4); medical (4) | 119 | 80 | mixed |
| 76 | 59 | 22 | additional participants were excluded because they became pregnant or started corticosteroid use | 148 | 121 | females |
| 64 | 27 | 58 | nd (reasons reported but not separately for exercise and control groups) | 141 | 55 | females |
| 16 | 10 | 38 | | 30 | 21 | females |
| 34 | 33 | 3 | unable to cope with trial (1) | 68 | 64 | females |
| 10 | 9 | 10 | unable to attend post-test evaluation (1) | 18 | 16 | males |

Group Characteristics

| n_m_e | n_f_e | n_m_c | n_f_c | race/ethnicity | age_e | agesd_e | age_r_e_l | age_r_e_u | age_c | agesd_c | age_r_c_l | age_r_c_u |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | | 19 | | 30.7 | 7.4 | 18 | 45 | 32.9 | 9.4 | 18.0 | 45.0 |
| | 13 | | | | 32.2 | 10.0 | 18 | 45 | | | | |
| | 16 | | | | 34.6 | 7.9 | 18 | 45 | | | | |
| | 30 | | 25 | white/not hispanic or latino | 38.4 | 7.4 | | | 36.4 | 7.6 | | |
| | 45 | | 32 | | 55.8 | 3.3 | | | 54.9 | 4.1 | | |
| | 24 | | 22 | | 53.7 | 3.2 | | | 53.4 | 4.5 | | |
| | 48 | | 44 | | 58.9 | 4.3 | 45 | 65 | 59.6 | 3.6 | 45.0 | 65.0 |
| | 12 | | 15 | | 47.3 | 2.1 | 44 | 51 | 47.0 | 2.7 | 41.0 | 51.0 |
| | 15 | | 10 | | 69.0 | 34.9 | 57.0 | 75 | 67.0 | 25.3 | 57.0 | 75.0 |
| | 9 | | 9 | | | | | | | | | |
| | 10 | | | | | | | | | | | |
| | 39 | | 40 | | 64.9 | 3.0 | 60.0 | 70.0 | 64.2 | 3.1 | 60.0 | 70.0 |
| | 10 | | 12 | east indian (1), all others white/not hispanic or latino | 56.8 | 6.3 | | | 58.8 | 6.2 | | |
| | 18 | | 22 | white | 58.0 | 6.0 | 50 | 70 | 59.0 | 6.0 | 50.0 | 70.0 |
| | 21 | | 19 | | 72.8 | 3.6 | 66 | 87 | 73.2 | 4.9 | 66.0 | 87.0 |
| | 32 | | 31 | white;asian/not hispanic or latino | 28.0 | 6.8 | 20 | 35 | 30.1 | 4.0 | 20.0 | 35.0 |
| | 71 | | 65 | | 54.8 | 4.0 | 40 | 65 | 54.9 | 5.0 | 40.0 | 65.0 |
| | 71 | | 59 | | 55.8 | 4.7 | 40 | 65 | 57.1 | 5.0 | 40.0 | 65.0 |
| | 5 | | 5 | white/not hispanic or latino | 56.6 | 4.3 | 50.0 | 61.0 | 56.0 | 4.5 | 53.0 | 64.0 |
| | 5 | | | white/not hispanic or latino | 54.0 | 1.9 | 51.0 | 56.0 | | | | |
| | 39 | | 45 | | 39.0 | 3.0 | 35.0 | 45.0 | 39.0 | 3.0 | 35.0 | 45.0 |
| | 26 | | 27 | | 53.1 | 0.9 | 52.0 | 53.0 | 53.1 | 0.8 | 52.0 | 53.0 |
| | 23 | | | | 52.9 | 0.9 | 52.0 | 53.0 | | | | |
| 30 | | 29 | | asian/not hispanic or latino | 68.2 | 2.4 | 65 | 74 | 68.1 | 2.7 | 65.0 | 74.0 |
| 29 | | | | asian/not hispanic or latino | 68.7 | 3.0 | 65 | 74 | | | | |
| | 28 | | 30 | asian/not hispanic or latino | 69.7 | 2.8 | 65 | 74 | 69.3 | 3.0 | 65.0 | 74.0 |
| | 30 | | | asian/not hispanic or latino | 69.6 | 3.2 | 65 | 74 | | | | |
| | 8 | | 20 | asian/not hispanic or latino | 65.3 | 4.7 | 53 | 77 | 64.9 | 5.7 | 53.0 | 77.0 |
| | 9 | | 9 | white/not hispanic or latino | 69.1 | 2.8 | | | 69.4 | 4.2 | | |
| | 115 | | 112 | white/not hispanic or latino | 68.9 | 3.9 | 65 | | 69.2 | 4.1 | 65.0 | |
| | 25 | | 25 | | 58.4 | 3.7 | 40 | 70 | 58.4 | 3.7 | 40 | 70 |
| | 21 | | 21 | | 55.7 | 4.7 | 40 | 70 | 55.7 | 4.7 | 40 | 70 |
| | 24 | | 36 | | 60.0 | 5.0 | | | 62.0 | 6.0 | | |
| | 30 | | | | 59.0 | 5.0 | | | | | | |
| 43 | | 43 | | white | 61.7 | 7.6 | 50 | 79 | 61.7 | 7.7 | 50.0 | 79.0 |
| 44 | | 42 | | white | 60.7 | 7.1 | 50 | 79 | 59.9 | 7.4 | 50.0 | 79.0 |
| | 15 | | 20 | | 23.0 | 4.2 | 20 | 35 | 25.0 | 4.7 | 20.0 | 35.0 |
| | 16 | | | | 25.0 | 4.4 | 20 | 35 | | | | |
| | 32 | | 32 | white | 79.6 | 2.1 | 75 | 85 | 79.5 | 3.2 | 75.0 | 85.0 |

Group Characteristics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 34 | | | white | 78.9 | 2.8 | 75 | 85 | | | | |
| | 22 | | 34 | white/not hispanic or latino | 34.2 | 2.6 | 28.0 | 39.0 | 34.4 | 2.7 | 28.0 | 39.0 |
| | 15 | | 20 | white | 67.3 | 5.2 | 61 | 83 | 67.9 | 5.9 | 61.0 | 83.0 |
| | 19 | | | white | 70.3 | 5.5 | 61 | 83 | | | | |
| | 27 | | 22 | white | 70.1 | 5.4 | 63 | 83 | 68.2 | 5.7 | 63.0 | 83.0 |
| | 20 | | 19 | white/not hispanic or latino | 60.3 | 7.8 | | | 56.7 | 6.9 | | |
| | 16 | | | white/not hispanic or latino | 57.8 | 7.1 | | | | | | |
| | 20 | | 19 | white/not hispanic or latino | 61.1 | 3.7 | 50.0 | 70.0 | 57.3 | 6.3 | 50.0 | 70.0 |
| | 23 | | 26 | white (34); hispanic (13); asian (1); indian (1) | 56.7 | 3.2 | 50 | 65 | 56.6 | 4.1 | 50.0 | 65.0 |
| | 31 | | 35 | | 63.0 | 5.0 | 50.0 | 70.0 | 62.0 | 5.0 | 50.0 | 70.0 |
| | 20 | | 18 | | 68.8 | 3.2 | 65 | 75 | 68.2 | 3.5 | 65.0 | 75.0 |
| | | | | white (43); black or african american (8); other (2) | 70.0 | 4.0 | 65 | | 69.0 | 4.0 | 65.0 | |
| 31 | 34 | 21 | 26 | white (95); other (17) | 83.0 | 4.0 | | | 83.0 | 4.0 | | |
| | 62 | | 59 | white (95); other (53) | 36.4 | 5.5 | 25 | 44 | 36.2 | 5.6 | 25.0 | 44.0 |
| | 28 | | 27 | | 24.0 | 3.8 | 18 | 31 | 24.2 | 3.7 | 18.0 | 31.0 |
| | 11 | | 10 | white/asian: 14/0 exercise, 15/1 control | 56.4 | 10.1 | | | 56.0 | 10.8 | | |
| | 31 | | 33 | asian | 55.2 | 2.8 | 45 | 60 | 54.9 | 2.9 | 45.0 | 60.0 |
| 7 | | 9 | | | 50.5 | 10.1 | 41 | 70 | 59.2 | 6.6 | 51.0 | 72.0 |

Group Characteristics

| ht_e | htsd_e | ht_c | htsd_c | ht_metric | drugs_e | drugs_desc_e |
|---|---|---|---|---|---|---|
| 164 | 5 | 162 | 6 | centimeters | | |
| 164 | 7 | | | centimeters | | |
| 163 | 8 | | | centimeters | | |
| 164 | 1.2 | 164 | 1.3 | centimeters | no | |
| 161 | 6 | 163 | 6 | centimeters | no | |
| 162 | 5 | 161 | 6 | centimeters | yes | |
| | | | | | no | |
| | | | | | no | no medication known to interfere with bone metabolism |
| | | | | | no | use of any medication that may alter calcium or bone metabolism |
| | | | | | | |
| | | | | | | |
| 161.9 | 6.1 | 162.9 | 7.3 | centimeters | no | none that could affect bone metabolism |
| 164 | 6.32 | 165 | 3.46 | centimeters | no | chronic medication use that might influence bone metabolism or calcium balance |
| 161 | 6 | 160 | 6 | centimeters | | no medication that influences glucose or lipid metabolism |
| 162 | 6.3 | 160.5 | 5.8 | centimeters | no | no medications known to affect bone metabolism |
| | | | | | | |
| 163.4 | 7.1 | 163.4 | 6.9 | centimeters | no | not using medications that alter bone density |
| 163.2 | 6.8 | 163 | 5.3 | centimeters | no | not using medications that alter bone density |
| | | | | | some | no drugs that could affect calcium metabolism and absorption |
| | | | | | some | no drugs that could affect calcium metabolism and absorption |
| 164 | 6 | 165 | 5 | centimeters | some | none that could affect the skeleton |
| 161 | 6 | 161 | 5 | centimeters | some | |
| 164 | 5 | | | centimeters | some | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 152 | 7.84 | 152 | 5.66 | centimeters | no | none that could affect bone metabolism |
| | | | | | | no osteoporosis medications but could have been taking other drugs that alter bmd |
| 161.8 | 6.1 | 160.5 | 5.8 | centimeters | no | no medication usage (bisphosphonates, hrt, glucocorticoids, laxatives) |
| 165.2 | 7 | 165.2 | 7 | centimeters | no | no medication known to affect bone density including estrogen, steroid hormones, or thiazide diuretics |
| 165.2 | 6.1 | 165.2 | 6.1 | centimeters | no | no medication known to affect bone density including estrogen, steroid hormones, or thiazide diuretics |
| 163.3 | 5.4 | 162.4 | 6.6 | centimeters | no | no hormone replacement therapy or other medications that could affect bone |
| 165.3 | 5.8 | | | centimeters | no | no hormone replacement therapy or other medications that could affect bone |
| 174.3 | 6.3 | 174.4 | 5.8 | centimeters | no | no medication known to affect bone metabolism |
| 174.2 | 6.6 | 175 | 6.6 | centimeters | no | no medication known to affect bone metabolism |
| 158 | 9.9 | 159 | 6 | centimeters | | |
| 158 | 8.3 | | | centimeters | | |
| 160.1 | 6 | 158.3 | 8.4 | centimeters | some | bisphosphonates (21); estrogen replacement therapy (4); no medications that would negatively affect bone density |

Group Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| 157 | 6.1 | | | centimeters | some | bisphosphonates (23); estrogen replacement therapy (5); no medications that would negatively affect bone density |
| 165 | 7.2 | 165.8 | 5.8 | centimeters | no | none that could affect bone metabolism |
| | | | | | no | no medication known to affect bone metabolism |
| | | | | | no | no medication known to affect bone metabolism |
| | | | | | no | no medication known to affect bone metabolism |
| 162.3 | 7.1 | 162.1 | 4.1 | centimeters | no | no medications in the last 12 months that could affect calcium metabolism |
| 159 | 5.1 | | | centimeters | no | no medications in the last 12 months that could affect calcium metabolism |
| 162.8 | 6.3 | 164 | 8.3 | centimeters | no | none that could affect bone metabolism |
| 163.3 | 4.4 | 161.7 | 6.6 | centimeters | no | no alendronate, tamoxifen, calcitonin, raloxifene, glucocorticoids, residronate |
| | | | | | no | none that could affect bone metabolism |
| 160.9 | 5.5 | 159.3 | 4.5 | centimeters | | |
| | | | | | no | no drugs that could affect bone health and metabolism |
| 164 | 10 | 163 | 9 | centimeters | no | exclusion criteria: use of bone-acting drugs within previous year |
| 166.3 | 5.6 | 165.5 | 6.5 | centimeters | | |
| 164.55 | 7.16 | 165.85 | 7.18 | centimeters | no | no chronic medication that could affect bone metabolism |
| 162 | 8 | 163.5 | 6.8 | centimeters | yes | prednisone (all); DMARD; NSAID |
| 155.3 | 6.3 | 156.7 | 6.3 | centimeters | no | no medication known to affect the skeleton |
| | | | | | no | not currently taking hormones, osteoporosis medications or steroids |

Group Characteristics

| drugs_c | drugs_desc_c | hrt_e | hrt_c | gluc_e | gluc_c | rheum_e |
|---|---|---|---|---|---|---|
| | | some | some | | | |
| | | some | | | | |
| | | some | | | | |
| no | | no | no | no | no | no |
| no | | no | no | no | no | no |
| yes | | yes | yes | no | no | no |
| no | | no | no | no | no | no |
| no | no medication known to interfere with bone metabolism | no | no | no | no | no |
| no | use of any medication that may alter calcium or bone metabolism | no | no | no | no | |
| | | some | some | | | |
| | | some | | | | |
| no | none that could affect bone metabolism | no | no | no | no | no |
| no | chronic medication use that might influence bone metabolism or calcium balance | no | no | no | no | no |
| | no medication that influences glucose or lipid metabolism | no | no | | | |
| no | no medications known to affect bone metabolism | no | no | no | no | |
| | | no | no | | | |
| no | not using medications that alter bone density | yes | yes | no | no | |
| no | not using medications that alter bone density | no | no | no | no | |
| no | no drugs that could affect calcium metabolism and absorption | some | some | no | no | |
| some | no drugs that could affect calcium metabolism and absorption | some | | no | | |
| some | none that could affect the skeleton | some | some | no | no | |
| some | | some | some | | | |
| | | some | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| no | none that could affect bone metabolism | no | no | no | no | |
| | no osteoporosis medications but could have been taking other drugs that alter bmd | no | no | | | |
| no | no medication usage (bisphosphonates, hrt, glucocorticoids, laxatives) | no | no | no | no | |
| no | no medication known to affect bone density including estrogen, steroid hormones, or thiazide diuretics | no | no | no | no | |
| no | no medication known to affect bone density including estrogen, steroid hormones, or thiazide diuretics | no | no | no | no | |
| no | no hormone replacement therapy or other medications that could affect bone | no | no | no | no | |
| | | no | | no | | |
| no | no medication known to affect bone metabolism | no | no | no | no | |
| no | no medication known to affect bone metabolism | no | no | no | no | |
| | | some | some | | | |
| | | some | | | | |
| some | bisphosphonates (22); estrogen replacement therapy (4); no medications that would negatively affect bone density | some | some | no | no | |

Group Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| | | some | | no | | |
| no | none that could affect bone metabolism | no | no | no | no | |
| no | no medication known to affect bone metabolism | no | no | no | no | |
| | | no | | no | | |
| no | no medication known to affect bone metabolism | no | no | no | no | |
| no | no medications in the last 12 months that could affect calcium metabolism | no | no | no | no | |
| | | no | | no | | |
| no | none that could affect bone metabolism | no | no | no | no | |
| no | no alendronate, tamoxifen, calcitonin, raloxifene, glucocorticoids, residronate | some | some | no | no | |
| no | none that could affect bone metabolism | no | no | no | no | |
| | | | | | | no |
| no | no drugs that could affect bone health and metabolism | | | no | no | |
| no | exclusion criteria: use of bone-acting drugs within previous year | no | no | no | no | some |
| | | some | some | | | |
| no | no chronic medication that could affect calcium metabolism | some | some | no | no | |
| yes | prednisone (all); DMARD; NSAID | | | yes | yes | yes |
| no | no medication known to affect the skeleton | no | no | no | no | |
| no | not currently taking hormones, osteoporosis medications or steroids | no | no | no | no | |

Group Characteristics

| rheum_c | osteo_e | osteo_c | osteo_sec_e | osteo_sec_c | osteopen_e | osteopen_c | smoke_e | smoke_c | alcoho_e | alcoho_c | regex_e | regex_c |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | yes | yes |
| | | | | | | | | | | | yes | |
| | | | | | | | | | | | yes | |
| no | no | no | no | no | | | some | some | | | yes | yes |
| no | no | no | no | no | | | some | some | | | yes | yes |
| no | no | no | no | no | | | some | some | | | yes | yes |
| no | some | some | no | no | some | some | some | some | | | yes | yes |
| no | no | no | no | no | no | no | some | some | | | yes | yes |
| | | | | | | | | | | | yes | yes |
| | | | | | | | | | | | yes | yes |
| | | | | | | | | | | | yes | |
| no | no | no | no | no | no | no | some | some | | | yes | yes |
| no | no | no | no | no | some | some | | | | | yes | yes |
| | | | | | | | no | no | some | some | yes | yes |
| | no | no | no | no | no | no | no | no | | | | |
| | no | no | no | no | no | no | | | | | yes | yes |
| | | | | | | | no | no | | | yes | yes |
| | | | | | | | no | no | | | yes | yes |
| | | | | | | | | | | | yes | yes |
| | | | | | | | | | | | yes | |
| | | | | | | | no | no | | | yes | yes |
| | | | | | | | no | no | | | yes | yes |
| | | | | | | | | | | | | |
| | | | | | | | some | some | no | some | yes | yes |
| | | | | | | | some | | some | | yes | |
| | | | | | | | some | some | no | no | yes | yes |
| | | | | | | | no | | no | | yes | |
| | yes | yes | | | no | no | | | | | yes | yes |
| | | | | | | | no | no | | | yes | yes |
| | some | some | no | no | | | some | some | | | yes | yes |
| | no | no | | | | | | | | | yes | yes |
| | no | no | | | | | | | | | yes | yes |
| | | | | | | | | | | | yes | yes |
| | | | | | | | | | | | yes | |
| | no | no | | | some | some | no | no | | | yes | yes |
| | no | no | | | some | some | no | no | | | yes | yes |
| | no | no | | | no | no | no | no | | | yes | yes |
| | no | | | | no | | no | | | | yes | |
| | some | some | | | some | some | some | some | | | yes | yes |

Group Characteristics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | some | | | | some | | some | | | | yes | |
| | | | | | | | | | | | yes | yes |
| | | | | | some | some | some | some | | | yes | yes |
| | | | | | some | | some | | | | yes | |
| | | | | | some | some | some | some | | | yes | yes |
| | | | | | | | no | no | | | yes | yes |
| | | | | | | | some | | | | yes | |
| | | | | | | | no | no | | | yes | yes |
| | | | no | no | some | some | some | some | some | some | yes | yes |
| | | | | | | | | | | | no | no |
| no | | | | | | | | | | | yes | yes |
| | | | | | | | no | no | | | yes | yes |
| some | some | some | | | some | some | | | | | yes | yes |
| | | | | | | | | | | | yes | yes |
| | no | no | no | no | no | no | | | | | yes | yes |
| yes | | | | | | | some | some | some | some | yes | yes |
| | | | | | | | no | no | | | yes | yes |
| | | | | | | | | | | | yes | yes |

Group Characteristics

| regex_desc |
|---|
| no more than 1 hour per week of high-impact or weight-bearing exercise |
| no more than 1 hour per week of high-impact or weight-bearing exercise |
| no more than 1 hour per week of high-impact or weight-bearing exercise |
| current or recent (12 months) participation in vigorous, regular exercise more than 1h/wk |
| current or recent (12 months) participation in vigorous, regular exercise more than 1h/wk |
| current or recent (12 months) participation in vigorous, regular exercise more than 1h/wk |
| not already training at the level of or above that of the intervention |
| most performed no regular physical training; none training at a level above that of the intervention |
| participation in a regular and structured physical activity for the last 3 months |
| none engaged in any type of competitive exercise and practiced sports occasionally at a recreational level |
| none engaged in any type of competitive exercise and practiced sports occasionally at a recreational level |
| not already taking regular exercise |
| recent participation in a vigorous exercise program |
| sedentary (no participation in a systematic/supervised exercise program in the last 5 years |
| assume subjects were generally inactive since 2 control subjects dropped because they started exercising |
| no history of vigorous physical activity or currently exercising greater than 3 strenuous hours per week |
| less than 120 minutes of physical activity per week and no weighlifting or similar activity |
| less than 120 minutes of physical activity per week and no weighlifting or similar activity |
| women not active during the last year |
| women not active during the last year |
| regular exercise not more than 2 times per week |
| vigorous exercise no more than 2 times per week |
| vigorous exercise no more than 2 times per week |
| no tai chi or other regular exercise |
| no tai chi or other regular exercise |
| no tai chi or other regular exercise |
| no tai chi or other regular exercise |
| no engagement in sporting activity in the previous 5 years |
| not participating in regular exercise for the previous 12 months |
| no participation in exercise studies in the past 2 years or athletic history last decade; average self-rated PA score 4 (range 1-7 with 1 low, 7 high) |
| not exercising for more than 3 hours per week at a high intensity; no racquet sports or weight training in last 5 years |
| not exercising for more than 3 hours per week at a high intensity; no racquet sports or weight training in last 5 years |
| not exercising for more than 2 hours per week at a moderate intensity; no weight training in last 5 years |
| not exercising for more than 2 hours per week at a moderate intensity; no weight training in last 5 years |
| no participation in resistance training in the past 12 months and/or high-impact weight bearing activities for greater than 30 minutes three times per week in the preceding 6 months |
| no participation in resistance training in the past 12 months and/or high-impact weight bearing activities for greater than 30 minutes three times per week in the preceding 6 months |
| not engaged in regular exercise training in the last 6 months and VO2 max less than or equal to 38 ml/kg/min |
| not engaged in regular exercise training in the last 6 months and VO2 max less than or equal to 38 ml/kg/min |
| not exercising regularly more than 2 times per week |

Group Characteristics

| |
|---|
| not exercising regularly more than 2 times per week |
| no history of participation in athletics, a regular exercise program for up to 2 years prior to the study; leisure or occupational activities requiring regular lifting, carrying or pushing against re |
| not engaged in regular exercise training in the last year |
| not engaged in regular exercise training in the last year |
| not engaged in regular exercise training in the last year |
| not involved in any systematic aerobic or strength training program in the last 12 months |
| not involved in any systematic aerobic or strength training program in the last 12 months |
| no strength training and less than 20 minutes of aerobic exercise two times per week |
| no current involvement in regular aerobic exercise and/or weight training exercise |
| excluded if exercising more than 1 hour per week in last year; average baseline physical activity equivalent to brisk walking 1.5 hours per day for the 2 most active hours in the day |
| no regular exercise of more than 30 minutes, 3 times per week; not actively engage in an organized activity program |
| sedentary lifestyle |
| sedentary |
| sedentary |
| minimally active (not exercising for more than 2 hours per week in the last year) |
| not currently exercising (but advised to continue with regular physical activities & therapy (physical and occupational) as needed |
| sedentary (no regular sports activities for at least 2 years) |
| sedentary (not currently participating in regular exercises such as walking, jogging, cycling, dance aerobics, strength training, etc. and have not done so for the previous 12 months) |

Group Characteristics

| pachange_e | pachange_c | meno_e | meno_c | meno_yrs_e | meno_yrs_sd_e | meno_yrs_c | meno_yrs_sd_c | calcium_e | calcium_c | vitd_e | vitd_c | fract_e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | premenopausal | premenopausal | | | | | no | no | no | no | |
| | | premenopausal | | | | | | no | | no | | |
| | | premenopausal | | | | | | no | | no | | |
| no change | no change | premenopausal | premenopausal | | | | | | | | | |
| no change | no change | postmenopausal | postmenopausal | 6.8 | 4.2 | 5.2 | 4 | some | some | | | |
| no change | no change | postmenopausal | postmenopausal | 6 | 4.3 | 6.7 | 4.1 | some | some | | | |
| | | postmenopausal | postmenopausal | | | | | yes | yes | yes | yes | yes |
| | | perimenopausal | perimenopausal | | | | | yes | yes | | | |
| | | postmenopausal | postmenopausal | | | | | | | | | no |
| | | postmenopausal | postmenopausal | | | | | | | | | |
| | | postmenopausal | | | | | | | | | | |
| | | postmenopausal | postmenopausal | 15.1 | 5.5 | 14.6 | 6.6 | | | | | |
| no change | no change | postmenopausal | postmenopausal | 8.6 | 6.96 | 8.3 | 5.89 | yes | yes | yes | yes | |
| | | postmenopausal | postmenopausal | 8 | 8 | 10 | 8 | | | | | |
| no change | no change | postmenopausal | postmenopausal | 24.7 | | 22.8 | | | | | | |
| | | premenopausal | premenopausal | | | | | some | some | yes | yes | |
| | | postmenopausal | postmenopausal | | | | | yes | yes | | | no |
| | | postmenopausal | postmenopausal | | | | | yes | yes | | | no |
| | | postmenopausal | postmenopausal | 3.47 | 2.01 | 3.9 | 1.75 | no | no | | | |
| | | postmenopausal | | 4.1 | 2.97 | | | no | | | | |
| no change | no change | premenopausal | premenopausal | | | | | | | | | |
| | | mixed | mixed | | | | | | | | | |
| | | mixed | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | postmenopausal | postmenopausal | | | | | | | | | |
| | | postmenopausal | | | | | | | | | | |
| | no change | postmenopausal | postmenopausal | 16.3 | 5.9 | 14.8 | 6.4 | yes | yes | yes | yes | |
| | | postmenopausal | postmenopausal | 23.7 | 11.3 | 22.1 | 11.2 | yes | yes | yes | yes | |
| no change | no change | postmenopausal | postmenopausal | 20.1 | | 19.4 | | yes | yes | yes | yes | |
| | | postmenopausal | postmenopausal | 7.8 | 3.5 | 7.8 | 3.5 | no | no | | | |
| | | postmenopausal | postmenopausal | 6.3 | 4 | 6.3 | 4 | no | no | | | |
| | | postmenopausal | postmenopausal | 11 | 6 | 12 | 6 | yes | yes | | | |
| | | postmenopausal | | 9 | 5 | | | yes | | | | |
| no change | no change | | | | | | | yes | yes | yes | yes | no |
| no change | no change | | | | | | | no | no | no | no | no |
| | | premenopausal | premenopausal | | | | | yes | yes | | | |
| | | premenopausal | | | | | | yes | | | | |
| | | postmenopausal | postmenopausal | 29.8 | 5 | 29.7 | 6.3 | no | no | no | no | some |

Group Characteristics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | postmenopausal | | 30.3 | 6.5 | | | no | | no | | some |
| no change | no change | premenopausal | premenopausal | | | | | yes | yes | | | |
| no change | no change | postmenopausal | postmenopausal | 19.7 | | 19.2 | | | | | | |
| no change | | postmenopausal | | 22 | | | | | | | | |
| no change | no change | postmenopausal | postmenopausal | 22.3 | | 20 | | | | | | |
| | | postmenopausal | postmenopausal | 12.75 | 8.75 | 8.5 | 7 | yes | yes | yes | yes | |
| | | postmenopausal | | 9.5 | 8.92 | | | yes | | yes | | |
| increase | decrease | postmenopausal | postmenopausal | 11.6 | 5 | 9.8 | 4.6 | some | some | | | some |
| | | postmenopausal | postmenopausal | 10 | 6.5 | 9.7 | 6.5 | yes | yes | | | no |
| | | postmenopausal | postmenopausal | 16 | 5 | 16 | 6 | yes | yes | | | |
| | | postmenopausal | postmenopausal | | | | | | | | | |
| | | postmenopausal | postmenopausal | | | | | yes | yes | yes | yes | |
| | | postmenopausal | postmenopausal | | | | | yes | yes | yes | yes | |
| no change | no change | premenopausal | premenopausal | | | | | no | no | no | no | |
| | | premenopausal | premenopausal | | | | | | | | | |
| | no change | mixed | mixed | | | | | yes | yes | yes | yes | no |
| | | postmenopausal | postmenopausal | 3.6 | 1.8 | 3.7 | 2.1 | no | no | no | no | |
| | | | | | | | | yes | yes | yes | yes | |

Group Characteristics

| fract_c | fract_par_e | fract_par_c | strength_e | ex_type | ex_type_other | length | freq_ae | freq_r_l_ae | freq_r_u_ae | int_ae | int_r_l_ae | int_r_u_ae |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | strength | unilateral hopping | 24 | | | | | | |
| | | | | strength | unilateral hopping | 24 | | | | | | |
| | | | | strength | unilateral hopping | 24 | | | | | | |
| | | | no change | strength | vertical jumps | 20 | | | | | | |
| | | | no change | strength | vertical jumps | 51 | | | | | | |
| | | | no change | strength | vertical jumps | 51 | | | | | | |
| yes | | | increase | both | | 52 | | 4 | 5 | | | |
| | | | no change | both | | 78 | 5 | | | | | |
| no | | | increase | strength | | 24 | | | | | | |
| | | | increase | strength | | 24 | | | | | | |
| | | | increase | strength | | 24 | | | | | | |
| | | | | aerobic | | 52 | 4 | 3.5 | 4.8 | 71 | | |
| | | | increase | strength | | 52 | | | | | | |
| | | | | both | | 24 | 3 | | | | 40 | 85 |
| | | | increase | both | aerobic,strength,balance,coordination | 47 | 2 | | | | | |
| | | | increase | both | | 104 | 2 | | | | 70 | 85 |
| no | | | increase | both | | 52 | 3 | | | 60 | | |
| no | | | increase | both | | 52 | 3 | | | 60 | | |
| | | | | aerobic | | 52 | 3 | | | | | |
| | | | | aerobic | | 52 | 3 | | | | | |
| | | | no change | aerobic | | 78 | 2.5 | | | | | |
| | | | no change | strength | | 78 | | | | | | |
| | | | no change | aerobic | | 78 | 3.2 | | | 72 | 55 | 75 |
| | | | no change | aerobic | tai chi | 52 | 3 | | | | | |
| | | | increase | strength | | 52 | | | | | | |
| | | | no change | aerobic | tai chi | 52 | 3 | | | | | |
| | | | no change | strength | | 52 | | | | | | |
| | | | | both | | 104 | 7 | | | | | |
| | | | no change | both | also did balance exercises | 32 | 3 | | | | | |
| | | | | both | | 78 | 2 | | | | 70 | 85 |
| | | | increase | strength | | 52 | | | | | | |
| | | | increase | strength | | 52 | | | | | | |
| | | | | strength | | 104 | | | | | | |
| | | | | both | | 104 | 3 | | | | | |
| no | | | increase | both | | 72 | 3 | | | | | |
| no | | | increase | both | | 72 | 3 | | | | | |
| | | | increase | strength | | 52 | | | | | | |
| | | | no change | aerobic | | 52 | 3 | | | | | |
| some | | | | strength | | 25 | | | | | | |

Group Characteristics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | other | agility training | 25 | 2 | | | | | |
| | | | increase | strength | | 78 | | | | | | |
| | | | increase | strength | | 32 | | | | | | |
| | | | no change | aerobic | | 32 | 3 | | | | 50 | 85 |
| | | | increase | both | | 32 | 2 | | | | | |
| | | | | aerobic | | 52 | 3 | | | 78.65 | 70 | 85 |
| | | | | aerobic | | 52 | 3 | | | 80.3 | 70 | 85 |
| some | | | increase | strength | | 52 | | | | | | |
| no | | | | other | jump training | 52 | 3 | | | | | |
| | | | | aerobic | | 104 | | | | 60 | | |
| | | | increase | strength | | 52 | | | | | | |
| | | | increase | both | | 52 | 3 | | | | 65 | 85 |
| | | | increase | both | | 24 | 2.2 | | | 80 | | |
| | | | increase | strength | | 104 | | | | | | |
| | | | increase | both | jump rope | 96 | | | | | | |
| no | | | | both | | 52 | 2.1 | | | | 60 | 75 |
| | | | | aerobic | | 24 | 3 | | | | | |
| | | | | aerobic | | 32 | 3 | | | | | |

Group Characteristics

| int_met_ae | int_other_ae | int_c_ae | dur_ae | dur_r_l_ae | dur_r_u_ae | prescription_ae |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | 25 | 30 | prescribed |
| | | | | 25 | 30 | prescribed |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| mhr | walked at brisk pace when hr not monitored | 53.13 | | 14.8 | 20.4 | completed |
| | | | | | | |
| hrr | also did interval training at 90% of MHR | | 30 | | | prescribed |
| | | | 10 | | | prescribed |
| mhr | | | 40 | | | prescribed |
| mhr | | 35.94 | | 20 | 25 | prescribed |
| mhr | | 35.94 | | 20 | 25 | prescribed |
| | | | 20 | | | prescribed |
| | | | 20 | | | prescribed |
| | | | 20 | | | completed |
| | | | | | | |
| vo2 | | 72.00 | 30 | | | completed |
| | | | 45 | | | prescribed |
| | | | | | | |
| | | | 45 | | | prescribed |
| | | | | | | |
| | | | | | | completed |
| | | | | 30 | 45 | prescribed |
| mhr | | | 20 | | | prescribed |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | prescribed |
| | | | | | | prescribed |
| | | | | | | prescribed |
| | | | | | | |
| | | | 40 | | | prescribed |
| | | | | | | |

Group Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 50 | | | prescribed |
| | | | | | | |
| | | | | | | |
| hrr | | | | 35 | 40 | prescribed |
| | | | 15 | | | prescribed |
| mhr | | 65.08 | 30 | | | prescribed |
| mhr | | 67.66 | 45 | | | prescribed |
| | | | | | | |
| | | | | | | prescribed |
| mhr | | 35.94 | | 180 | 240 | prescribed |
| | | | | | | |
| mhr | | | | | | prescribed |
| mhr | | 67.19 | 25 | 15 | 30 | completed |
| | | | | | | |
| | | | | | | prescribed |
| mhr | | | | 15 | 20 | completed |
| other | walk 5 to 6 km/hr | | 45 | | | prescribed |
| | | | 50 | | | prescribed |

Group Characteristics

| mode_ae |
|---|
| |
| |
| |
| |
| |
| |
| walk/other |
| walk/other |
| |
| |
| |
| walk |
| |
| cycle/jog/walk |
| walk/jog/other |
| high-impact aerobic workout (low-impact available) |
| walk/jog/other |
| walk/jog/other |
| charleston/heel jack without jump/fast walk/slow walk |
| jumping jacks/knee-to-elbow jump/running in place |
| jump training |
| other |
| cycle/jog/stairclimb/walk/other |
| Yang style of tai chi (24 forms) |
| |
| Yang style of tai chi (24 forms) |
| |
| walk |
| walk/stair climb |
| aerobic dance |
| |
| |
| |
| stationary cycling as part of a circuit training program |
| 3 sets of 10 to 20 repetitions of single and double foot landings, bench stepping and jumping |
| 3 sets of 10 to 20 repetitions of single and double foot landings, bench stepping and jumping |
| |
| step/hop/w/run/2-legged hops |
| |

Group Characteristics

| |
|---|
| other |
| |
| |
| stepping, skipping, graded walking, jogging, dancing, aerobics and step choreographies |
| weight bearing exercise (moderate to high impact marching in place, stepping exercise, heel drops) |
| jog/walk |
| jog/walk |
| |
| other |
| walk/other |
| |
| stair climbing, stationary cycling, walking on a treadmill |
| walking on treadmill, cycling, rowing |
| |
| other |
| walking & marching combined with repetitive arm movements |
| walking |
| walking with weighted vest |

Group Characteristics

| mode_ae_other | comply_ae | comply_r_l_ae | comply_r_u_ae |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| 3 walks/wk plus 25 min aerobic ex in training session mixed with 25 min strengthening workout | 95 | | |
| 3 walks/wk plus 25 min aerobic ex in training session mixed with 25 min strengthening workout | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| also did 1-2 days per week of interval training after 3 months (4 minutes of exerxcise, 3 minutes of recovery) | | | |
| steps, arm movements | 67 | 23 | 95 |
| | 61.3 | | |
| skip/hop/sc/step box w/weighted vests | 79.9 | | |
| skip/hop/sc/step box w/weighted vests | 79.9 | | |
| | 80 | | |
| | 82.6 | | |
| | 83 | | |
| calisthenics | | | |
| graded treadmill exercises | 80 | | |
| | 77 | | |
| | | | |
| | 84 | | |
| | | | |
| increased daily step count by 61.3% per day | | | |
| wore weighted vest while walking and stair climbing | | | |
| | 76.3 | | |
| | | | |
| | | | |
| | | | |
| | 77 | | |
| moderate-impact weight bearing exercises in between resistance training exercises | 63 | | |
| moderate-impact weight bearing exercises in between resistance training exercises | 63 | | |
| | | | |
| | | | |
| | | | |

Group Characteristics

| | | | |
|---|---|---|---|
| ball games, relay races, dance movements, obstacle courses | 87 | | |
| | | | |
| | | | |
| | 77.7 | 64.2 | 96.8 |
| | 72.4 | 51.6 | 85.9 |
| | 78.35 | | |
| | 83.8 | | |
| | | | |
| multidirectional jumping (25 to 200 jumps per session) progressing from the floor to 4 inch and then 6 inch steps | 75 | | |
| | 39 | | |
| | | | |
| | 88 | 85 | 92 |
| | 73.3 | | |
| | | | |
| jump rope | 43.7 | | |
| | 71 | | |
| | | | |
| | 96 | | |

Group Characteristics

| comply_notes_ae | tmin_ae | tmin_adj | supervision_ae | location_ae |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | both | home and facility based |
| | | | both | home and facility based |
| | | | both | home and facility based |
| | | | unsupervised | |
| | | | unsupervised | |
| | | | | |
| | | | | |
| | | | | |
| | | | both | home and facility based |
| | | | | |
| subjects had to attend at least 85% of sessions to be included | 90.00 | | supervised | facility based |
| for combined program | 20.00 | 13.40 | supervised | home and facility based |
| | 80.00 | 49.04 | supervised | facility based |
| for exercise completers only | | | supervised | facility based |
| for exercise completers only | | | supervised | facility based |
| | 60.00 | 48.00 | supervised | facility based |
| | 60.00 | 49.56 | supervised | facility based |
| | 50.00 | 41.50 | supervised | facility based |
| | | | both | |
| | 96.00 | 76.80 | both | |
| | 135.00 | 103.95 | both | home and facility based |
| | | | | |
| | 135.00 | 113.40 | both | home and facility based |
| | | | | |
| | | | unsupervised | home based |
| | | | supervised | facility based |
| | 40.00 | 30.52 | supervised | facility based |
| | | | | |
| | | | | |
| | | | | |
| compliance for combined ae & wt | | | supervised | facility based |
| 95% CI, 57% to 69% | | | supervised | facility based |
| 95% CI, 57% to 69% | | | supervised | facility based |
| | | | | |
| had to attend at least 80% of sessions | 120.00 | | supervised | facility based |
| | | | | |

Group Characteristics

| | | | | |
|---|---|---|---|---|
| | 100.00 | 87.00 | supervised | facility based |
| | | | | |
| | | | | |
| also did strength exercises for the first 6 weeks | | | supervised | facility based |
| median versus mean reported; compliance for both ae and st | 30.00 | 21.72 | supervised | facility based |
| | 90.00 | 70.52 | supervised | facility based |
| | 135.00 | 113.13 | supervised | facility based |
| | | | | |
| | | | both | home and facility based |
| | | | both | home and facility based |
| | | | | |
| reported as median and interquartile range and combined for aerobic and weight training groups | | | supervised | facility based |
| | 55.00 | 40.32 | supervised | facility based |
| | | | | |
| | 60.00 | 26.22 | unsupervised | home and facility based |
| compliance for combined aerobic & weight training | | | unsupervised | home based |
| number of steps increased in walking group | 135.00 | | supervised | facility based |
| | 150.00 | 144.00 | unsupervised | home based |

Group Characteristics

| participation_ae | freq_str | freq_r_l_str | freq_r_u_str | int_str | int_r_l_str | int_r_u_str | dur_str | dur_r_l_str | dur_r_u_str | sets_str | sets_l_str | sets_u_str | reps_str |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | | | | | | | | 5 | | | 10 |
| | 4 | | | | | | | | | 5 | | | 10 |
| | 7 | | | | | | | | | 5 | | | 10 |
| group & self | 6 | | | | | | 10 | | | 5 | | | 10 |
| group & self | 6 | | | | | | 10 | | | 5 | | | 10 |
| group & self | 6 | | | | | | 10 | | | 5 | | | 10 |
| | | 1 | 2 | | | | 25 | | | | | | |
| | 2 | | | | | | 25 | | | | | | |
| | 3 | | | 85 | 50 | 85 | 60 | | | 3 | | | 10 |
| | 3 | | | | 45 | 80 | 55 | | | | 2 | 4 | |
| | 3 | | | | 45 | 60 | 55 | | | | 2 | 3 | |
| group & self | | | | | | | | | | | | | |
| | 3 | | | 70 | | | | | | 2 | | | |
| | 3 | | | | 60 | 85 | 30 | | | | 1 | 4 | |
| group & self | 2 | | | | | | 12 | | | 2 | | | |
| group | 3 | | | | | | 40 | | | | | | |
| | 3 | | | | 70 | 80 | | | | 2 | | | |
| | 3 | | | | 70 | 80 | | | | 2 | | | |
| group | | | | | | | | | | | | | |
| group | | | | | | | | | | | | | |
| group | | | | | | | | | | | | | |
| | 2.6 | | | | | | 30 | | | 3 | | | 16 |
| | | | | | | | | | | | | | |
| group & self | | | | | | | | | | | | | |
| | 3 | | | | | | | | | 1 | | | 30 |
| group & self | | | | | | | | | | | | | |
| | 3 | | | | | | | | | 1 | | | 30 |
| self | 5 | 5 | 7 | | | | | | | 2 | | | 15 |
| | 3 | | | | 50 | 75 | | 30 | 45 | | | | |
| group | 4 | | | | | | | | | | 1 | 3 | |
| | 3 | | | 50.9 | 40 | 60 | | 20 | 30 | 3 | | | 8 |
| | 3 | | | 15.45 | 10 | 20 | | 45 | 60 | 3 | | | 20 |
| | 3 | | | | | | 30 | | | 3 | | | 8 |
| | 3 | | | | | | 30 | | | | | | |
| | 3 | | | | 50 | 85 | | | | | 2 | 3 | |
| | 3 | | | | 50 | 85 | | | | | 2 | 3 | |
| | 2.3 | | | | 65 | 80 | 40 | | | | 1 | 3 | |
| group | | | | | | | | | | | | | |
| | 2 | | | | 50 | 85 | 50 | | | 2 | | | |

## Group Characteristics

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| group | | | | | | | | | | | | | |
| | 3 | | | | 70 | 80 | 60 | | | 3 | | | |
| | 3 | | | | 50 | 80 | | 30 | 40 | 2 | | | |
| group | | | | | | | | | | | | | |
| group | 2 | | | | | | 10 | | | 3 | 1 | 3 | |
| self | | | | | | | | | | | | | |
| self | | | | | | | | | | | | | |
| | 2 | | | 80 | | | 45 | | | 3 | | | 8 |
| group & self | | | | | | | | | | | | | |
| group & self | | | | | | | | | | | | | |
| | 3 | | | 75 | | | 60 | | | 3 | | | 8 |
| group | 3 | | | | 65 | 80 | | | | | 1 | 3 | |
| | 2.2 | | | 73 | 65 | 100 | | | | | 1 | 3 | |
| | 2 | | | | | | | | | 3 | | | |
| self | 3 | | | 70 | | | 16 | | | 2 | | | |
| self | 2.1 | | | | | | | 10 | 15 | | | | |
| group | | | | | | | | | | | | | |
| self | | | | | | | | | | | | | |

Group Characteristics

| reps_l_str | reps_u_str | rest_str | rest_l_str | rest_u_str | exn_str | equipment_str | prescription_str | type_str |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | body weight | prescribed | other |
| | | | | | 1 | body weight | prescribed | other |
| | | | | | 1 | body weight | prescribed | other |
| | | | | | 1 | | prescribed | other |
| | | | | | 1 | | prescribed | other |
| | | | | | 1 | | prescribed | other |
| | | | | | | | prescribed | |
| | | | | | | | prescribed | |
| | | 60 | | | 12 | | prescribed | traditional |
| 6 | 20 | 120 | | | 10 | machine and free weights | prescribed | traditional |
| 10 | 20 | 0 | | | 10 | machine and free weights | prescribed | circuit |
| | | | | | | | | |
| 8 | 10 | | | | 12 | plate loaded machines (Pulse Fitness Systems & Life Fitness) | prescribed | traditional |
| 4 | 15 | | | | | free weights and selective plate machines | prescribed | traditional |
| 8 | 12 | | | | | body weight and dumbells | prescribed | |
| | | | | | | body weight, dumbells, barbells, ankle/wrist weights | prescribed | other |
| 6 | 8 | | | | 7 | free weights, machine, therabands, physiotherapy balls, weighted vests | prescribed | traditional |
| 6 | 8 | | | | 7 | free weights, machine, therabands, physiotherapy balls, weighted vests | prescribed | traditional |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | 8 | wrist and ankle weights | completed | other |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | 7 | therabands | prescribed | other |
| | | | | | | | | |
| | | | | | 7 | therabands | prescribed | other |
| | | | | | 4 | body weight | completed | other |
| 8 | 10 | | | | | Nautilus-type machines | prescribed | traditional |
| 8 | 15 | | 20 | | 12 | body weight and therabands | prescribed | other |
| 8 | 10 | | 120 | 180 | 11 | free weights & resistance machines | prescribed | traditional |
| 20 | 25 | | 120 | 180 | 11 | free weights & resistance machines | prescribed | traditional |
| | | | | | 9 | | prescribed | traditional |
| | | 10 | | | 9 | | prescribed | circuit |
| 8 | 20 | | | | 8 | machine and free weights | prescribed | |
| 8 | 20 | | | | 8 | machine and free weights | prescribed | |
| 8 | 15 | | | | 8 | | completed | circuit |
| | | | | | | | | |
| 6 | 15 | | | | 9 | Keiser pneumatic resistance machines & free weights | prescribed | traditional |

Group Characteristics

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 8 | 12 | | | | 12 | free weights | prescribed | traditional |
| 6 | 15 | 120 | | | 8 | variable resistance machines (Nautilus) | prescribed | traditional |
| | | | | | | | | |
| 8 | 15 | | | | | weighted vests, elastic bands and dumbells | prescribed | other |
| | | | | | | | | |
| | | | | | | | | |
| | | | 90 | 120 | 5 | Keiser pneumatic resistance machines | prescribed | traditional |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | 6 | Universal Gym | prescribed | circuit |
| 6 | 12 | | | | 9 | machines | prescribed | traditional |
| 6 | 12 | | | | 8 | | completed | traditional |
| 8 | 10 | | | | | variable resistance machines and free weights | prescribed | traditional |
| 8 | 12 | 15 | | | 16 | Universal super circuit | prescribed | circuit |
| | | | | | | hand and cuff weights | completed | other |
| | | | | | | | | |
| | | | | | | | | |

Group Characteristics

| mode_str | mode_other_str | comply_str |
|---|---|---|
| yes | hopping on one limb; subjects completed 86 hops per week | 84 |
| yes | hopping on one limb; subjects completed 189 hops per week | 90 |
| yes | hopping on one limb; subjects completed 312 hops per week | 86 |
| yes | | |
| yes | | |
| yes | | |
| yes | | 95 |
| yes | | |
| yes | emphasis was on eccentric contractions | 90 |
| yes | | |
| yes | | |
| | | |
| yes | | 77.6 |
| yes | movement centered around 3 core exercises: leg press, bench press, lat pulldown | |
| yes | also performed exercises for static and dynamic balance | 67 |
| yes | Variety Training Program (circuit training); other (traditional) | 61.3 |
| yes | | 79.9 |
| yes | | 79.9 |
| | | |
| | | |
| | | |
| yes | 8 rhythmic muscular strength-endurance calisthenics exercises | 66 |
| | | |
| | | |
| yes | therabands | 73 |
| | | |
| yes | therabands | 80 |
| yes | | |
| yes | | |
| yes | isometric and isotonic exercise in circuit and traditional format, balance, gymanstics, stretching | 59.25 |
| yes | | 87 |
| yes | | 89 |
| yes | | 74 |
| yes | subjects performed all exercises for 40 seconds followed by a 10 second break | 77 |
| yes | squats or leg press, lunges, hip aduction/abduction, pulldown or seated row, back extension, combincation of abdominal and core stability exercises | 63 |
| yes | squats or leg press, lunges, hip aduction/abduction, pulldown or seated row, back extension, combination of abdominal and core stability exercises | 63 |
| yes | | |
| | | |
| yes | | 85 |

Group Characteristics

| | | |
|---|---|---|
| | | |
| yes | | 84 |
| yes | | 78.4 |
| | | |
| yes | squats while wearing weighted vests, hip flexors, extensors, abductors, knee flexors and extensors, upper body exercises | 72.4 |
| | | |
| | | |
| yes | | 87.5 |
| | | |
| | | |
| yes | | 85 |
| yes | | 88 |
| yes | | 73.3 |
| yes | | 67 |
| yes | participants performed super circuit training | 46.7 |
| yes | low load strengthening exercises for the major peripheral muscle groups | 71 |
| | | |
| | | |

| comply_r_l_str | comply_r_u_str | comply_notes_str | supervision_str |
|---|---|---|---|
| 65 | 100 | | unsupervised |
| 74 | 100 | | unsupervised |
| 65 | 97 | | unsupervised |
| | | Compliance reported as the median + IQR (69% + 27%) | both |
| | | Compliance reported as the median + IQR (91% + 13%) | both |
| | | Compliance reported as the median + IQR (91% + 13%) | both |
| | | | unsupervised |
| | | | unsupervised |
| | | compliance was at least 90% | supervised |
| | | | supervised |
| | | | supervised |
| | | | |
| | | | supervised |
| | | also did 1-2 days per week of interval training after 3 months (4 minutes of exerxcise, 3 minutes of recovery) | supervised |
| 23 | 95 | compliance for combined program | supervised |
| | | compliance for intervention (3 alternating classes: aerobic, circuit, traditional) | supervised |
| | | for exercise completers only | supervised |
| | | for exercise completers only | supervised |
| | | | |
| | | | |
| | | | |
| | | | both |
| | | | |
| | | | |
| | | | supervised |
| | | | |
| | | | supervised |
| | | | unsupervised |
| | | | supervised |
| | | averaged group (76.3%) and home-based (42.2%) compliance | both |
| 67 | 98 | | supervised |
| 69 | 100 | | supervised |
| | | | supervised |
| | | compliance for combined ae & wt | supervised |
| | | 95% CI, 57% to 69% | supervised |
| | | 95% CI, 57% to 69% | supervised |
| | | has to attend at least 80% of the sessions | supervised |
| | | | |
| | | | supervised |

Group Characteristics

| | | | |
|---|---|---|---|
| | | | |
| | | | supervised |
| 61.6 | 95.9 | | supervised |
| | | | |
| 51.6 | 85.9 | median versus mean reported; compliance for both ae and st | supervised |
| | | | |
| | | | |
| | | | supervised |
| | | | |
| | | | |
| | | 86% for first 3 months; 85% for last 9 months | both |
| 85 | 92 | reported as median and interquartile range and combined for aerobic and weight training groups | supervised |
| | | | supervised |
| 30 | 100 | | both |
| | | | unsupervised |
| | | compliance for combined aerobic & weight training | unsupervised |
| | | | |
| | | | |

Group Characteristics

| location_str | participation_str | BPAQ_1 | BPAQ_2 | load stimulus_bpaq1 | load stimulus_bpaq2 | load rating_bpaq1 | load rating_bpaq2 | grf | rfa |
|---|---|---|---|---|---|---|---|---|---|
| home based | self | 6.44 | 0.53 | 4.88 | 0.40 | 122.0 | 10.0 | 2.8 | |
| home based | self | 8.59 | 0.7 | 4.88 | 0.40 | 122.0 | 9.9 | 2.8 | |
| home based | self | 10.74 | 0.88 | 4.44 | 0.36 | 111.0 | 9.1 | 2.8 | |
| home and facility based | group & self | 27.24 | 27.24 | 13.62 | 13.62 | 340.5 | 340.5 | 3.01 | 43.0 |
| home and facility based | group & self | 27.24 | 27.24 | 13.62 | 13.62 | 340.5 | 340.5 | 3.96 | 155.6 |
| home and facility based | group & self | 27.24 | 27.24 | 13.62 | 13.62 | 340.5 | 340.5 | 3.96 | 156.8 |
| | | | 0.72 | | | | | | |
| | | | 0.72 | | 0.40 | | 10.0 | | |
| facility based | | 0.71 | 0.56 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| facility based | | | | | | | | | |
| facility based | | | | | | | | | |
| | | 0.64 | 0.64 | 0.38 | 0.38 | 9.4 | 9.4 | | |
| facility based | | 0.71 | 0.56 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| facility based | | | 0.56 | | 0.40 | | 10.0 | | |
| home and facility based | group & self | | 0.48 | | 0.40 | | 10.0 | | |
| facility based | group | 30.59 | 30.51 | 23.17 | 23.11 | 579.4 | 577.8 | | |
| facility based | | | 0.56 | | 0.40 | | 10.0 | | |
| facility based | | | 0.56 | | 0.40 | | 10.0 | | |
| | | 2.35 | 0.56 | 1.68 | 0.40 | 42.0 | 10.0 | 1.3 | |
| | | 9.13 | 19.07 | 6.52 | 13.62 | 163.0 | 340.5 | 2.9 | |
| | | 77.02 | 77 | 59.25 | 59.23 | 1481.2 | 1480.8 | 3.85 | |
| | | 0.71 | 0.56 | 0.54 | 0.42 | 13.4 | 10.6 | | |
| | | 2.01 | 0.56 | 1.40 | 0.39 | 34.9 | 9.7 | | |
| | | | 0.56 | | 0.40 | | 10.0 | | |
| facility based | group | 0.71 | 0.56 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| | | | 0.56 | | 0.40 | | 10.0 | | |
| facility based | group | 0.71 | 0.56 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| home based | | | 0.88 | | 0.40 | | 10.0 | | |
| facility based | | | 0.56 | | 0.40 | | 10.0 | | |
| home and facility based | group & self | | 0.64 | | 0.53 | | 13.3 | | |
| facility based | | 0.71 | 0.56 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| facility based | | 0.71 | 0.56 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| facility based | | 0.71 | 0.56 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| facility based | | | 0.56 | | 0.40 | | 10.0 | | |
| facility based | | 77.02 | 77 | 55.01 | 55.00 | 1375.4 | 1375.0 | 5.6 | |
| facility based | | 77.02 | 77 | 55.01 | 55.00 | 1375.4 | 1375.0 | 5.6 | |
| facility based | | 0.79 | 0.62 | 0.57 | 0.45 | 14.2 | 11.2 | | |
| | | 84.72 | 84.7 | 55.01 | 55.00 | 1375.3 | 1375.0 | 4.2 | 87.8 |
| facility based | group | 0.61 | 0.48 | 0.51 | 0.40 | 12.7 | 10.0 | | |

Group Characteristics

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.48 | | | | | 3 | |
| facility based | | 0.79 | 0.62 | 0.51 | 0.40 | 12.8 | 10.1 | | |
| facility based | other | 0.71 | 0.56 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| | | | | | | | | | |
| facility based | group | 5.66 | 16.34 | 4.72 | 13.62 | 117.9 | 340.4 | 2.06 | |
| | | 0.56 | 0.56 | 0.40 | 0.40 | 10.0 | 10.0 | | |
| | | 0.56 | 0.56 | 0.40 | 0.40 | 10.0 | 10.0 | | |
| facility based | | 0.61 | 0.48 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| | | 17.71 | 19.07 | | | | | | |
| | | 0.64 | 0.64 | | | | | | |
| facility based | | 0.71 | 0.56 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| facility based | group | | 0.56 | | 0.40 | | 10.0 | | |
| facility based | | | 0.48 | | 0.39 | | 9.7 | | |
| facility based | group & self | 0.61 | 0.48 | 0.51 | 0.40 | 12.7 | 10.0 | | |
| facility based | self | | | | | | | | |
| home based | self | | 0.48 | | 0.39 | | 9.8 | | |
| | | 0.56 | 0.56 | 0.40 | 0.40 | 10.0 | 10.0 | | |
| | | 0.56 | 0.56 | 0.40 | 0.40 | 10.0 | 10.0 | | |

Group Characteristics

| elr | els | forces |
|---|---|---|
| | | ground reaction |
| | | ground reaction |
| | | ground reaction |
| 129.4 | 5.1772 | ground reaction |
| 616.0 | 24.640704 | ground reaction |
| 620.8 | 24.832368 | ground reaction |
| | | both |
| | | both |
| | | joint reaction |
| | | joint reaction |
| | | joint reaction |
| | | ground reaction |
| | | joint reaction |
| | | both |
| | | both |
| | | both |
| | | both |
| | | both |
| | | ground reaction |
| | | ground reaction |
| | | ground reaction |
| | | joint reaction |
| | | ground reaction |
| | | joint reaction |
| | | joint reaction |
| | | joint reaction |
| | | joint reaction |
| | | both |
| | | both |
| | | both |
| | | joint reaction |
| | | joint reaction |
| | | joint reaction |
| | | joint reaction |
| | | both |
| | | both |
| | | joint reaction |
| 368.8 | 14.7504 | ground reaction |
| | | joint reaction |

Group Characteristics

| | | |
|---|---|---|
| | | ground reaction |
| | | joint reaction |
| | | joint reaction |
| | | ground reaction |
| | | both |
| | | ground reaction |
| | | ground reaction |
| | | joint reaction |
| | | ground reaction |
| | | ground reaction |
| | | joint reaction |
| | | both |
| | | both |
| | | joint reaction |
| | | both |
| | | both |
| | | ground reaction |
| | | both |

Group Characteristics

| **notes_gc** |
| --- |
| used running & jogging for BPAQ score |
| used running & jogging for BPAQ score |
| used running & jogging for BPAQ score |
| no hrt for at least 12 months |
| no hrt for at least 12 months |
| hrt for at least 12 months |
| |
| |
| |
| |
| |
| data for 1 exercise participant excluded because of hyperthyroidism |
| |
| |
| |
| total exercise time was 108 minutes per week |
| women were 3 to 10.9 years postmenopausal; taking hrt for 1-5.9 years |
| women were 3 to 10.9 years postmenopausal; not taking hrt for >1 year |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| 12 fractures from falls in controls versus 6 in exercisers during the study |
| |
| |
| |
| |
| participants did resistance training with weight bearing exercise interspersed between each weight training exercise |
| participants did resistance training with weight bearing exercise interspersed between each weight training exercise |
| |
| |
| |

Group Characteristics

| |
|---|
| |
| |
| participants encouraged to exercise with a partner |
| |
| participants also performed 10 minutes of static and dynamic balance exercises |
| |
| |
| |
| 20 control subjects walked; one control subject stair climbed; one control subject  rowed and hiked |
| |
| |
| |
| subjects performed flexibility, balance and coordination exercises, added weight training, and then added aerobic exercise |
| |
| couldn't calculate BPAQ score because no frequency for jumping rope prescribed |
| |
| |
| subjects with femoral neck or lumbar spine BMD 3.5 SD below young healthy normal controls excluded from study; subjects walked wth weighted vest |

Outcome Characteristics

| study_id3_new | author3 | group_id2 | outcome_id | outcome_variable | outcome_other | outcome_class | outcome_test |
|---|---|---|---|---|---|---|---|
| 2 | Bailey & Brooke-Wavell | 1 | 1 | femoral neck | | primary | dexa |
| 2 | Bailey & Brooke-Wavell | 1 | 2 | other | upper femoral neck | secondary | dexa |
| 2 | Bailey & Brooke-Wavell | 1 | 3 | other | lower femoral neck | secondary | dexa |
| 2 | Bailey & Brooke-Wavell | 1 | 4 | trochanter(ic) | | secondary | dexa |
| 2 | Bailey & Brooke-Wavell | 1 | 5 | body weight | | secondary | other |
| 2 | Bailey & Brooke-Wavell | 1 | 6 | body mass index | | secondary | other |
| 2 | Bailey & Brooke-Wavell | 1 | 7 | percent body fat | | secondary | other |
| 2 | Bailey & Brooke-Wavell | 2 | 1 | femoral neck | | primary | dexa |
| 2 | Bailey & Brooke-Wavell | 2 | 2 | other | upper femoral neck | secondary | dexa |
| 2 | Bailey & Brooke-Wavell | 2 | 3 | other | lower femoral neck | secondary | dexa |
| 2 | Bailey & Brooke-Wavell | 2 | 4 | trochanter(ic) | | secondary | dexa |
| 2 | Bailey & Brooke-Wavell | 2 | 5 | body weight | | secondary | other |
| 2 | Bailey & Brooke-Wavell | 2 | 6 | body mass index | | secondary | other |
| 2 | Bailey & Brooke-Wavell | 2 | 7 | percent body fat | | secondary | other |
| 2 | Bailey & Brooke-Wavell | 3 | 1 | femoral neck | | primary | dexa |
| 2 | Bailey & Brooke-Wavell | 3 | 2 | other | upper femoral neck | secondary | dexa |
| 2 | Bailey & Brooke-Wavell | 3 | 3 | other | lower femoral neck | secondary | dexa |
| 2 | Bailey & Brooke-Wavell | 3 | 4 | trochanter(ic) | | secondary | dexa |
| 2 | Bailey & Brooke-Wavell | 3 | 5 | body weight | | secondary | other |
| 2 | Bailey & Brooke-Wavell | 3 | 6 | body mass index | | secondary | other |
| 2 | Bailey & Brooke-Wavell | 3 | 7 | percent body fat | | secondary | other |
| 302 | Bassey et al. | 1 | 1 | lumbar spine | | primary | dexa |
| 302 | Bassey et al. | 1 | 2 | femoral neck | | primary | dexa |
| 302 | Bassey et al. | 1 | 3 | trochanter(ic) | | secondary | dexa |
| 302 | Bassey et al. | 1 | 4 | body weight | | secondary | |
| 302 | Bassey et al. | 1 | 5 | body mass index | | secondary | |
| 302 | Bassey et al. | 1 | 6 | muscular power-lower | | secondary | |
| 302 | Bassey et al. | 1 | 7 | balance-dynamic | | secondary | |
| 302 | Bassey et al. | 2 | 1 | lumbar spine | | primary | dexa |
| 302 | Bassey et al. | 2 | 2 | femoral neck | | primary | dexa |
| 302 | Bassey et al. | 2 | 3 | trochanter(ic) | | secondary | dexa |
| 302 | Bassey et al. | 2 | 4 | body weight | | secondary | |
| 302 | Bassey et al. | 2 | 5 | body mass index | | secondary | |
| 302 | Bassey et al. | 2 | 6 | calcium intake | | secondary | |
| 302 | Bassey et al. | 3 | 1 | lumbar spine | | primary | dexa |
| 302 | Bassey et al. | 3 | 2 | femoral neck | | primary | dexa |
| 302 | Bassey et al. | 3 | 3 | trochanter(ic) | | secondary | dexa |
| 302 | Bassey et al. | 3 | 4 | body weight | | secondary | |
| 302 | Bassey et al. | 3 | 5 | body mass index | | secondary | |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 302 | Bassey et al. | 3 | 6 | calcium intake | | secondary | |
| 302 | Bassey et al. | 3 | 7 | balance-dynamic | | secondary | |
| 298 | Bergstrom et al. | 1 | 1 | body mass index | | secondary | other |
| 298 | Bergstrom et al. | 1 | 2 | muscular strength-lower | | secondary | other |
| 298 | Bergstrom et al. | 1 | 3 | lumbar spine | L1-L4 | primary | dexa |
| 298 | Bergstrom et al. | 1 | 4 | lumbar spine | L2-L4 | primary | dexa |
| 298 | Bergstrom et al. | 1 | 5 | hip-total | | secondary | dexa |
| 298 | Bergstrom et al. | 1 | 6 | femoral neck | | primary | dexa |
| 298 | Bergstrom et al. | 1 | 7 | muscular strength-lower | | secondary | other |
| 298 | Bergstrom et al. | 1 | 8 | lumbar spine | L1-L4 | primary | dexa |
| 298 | Bergstrom et al. | 1 | 9 | lumbar spine | L2-L4 | primary | dexa |
| 298 | Bergstrom et al. | 1 | 10 | hip-total | | secondary | dexa |
| 298 | Bergstrom et al. | 1 | 11 | femoral neck | | primary | dexa |
| 1057 | Bergstrom et al. | 1 | 1 | body mass index | | secondary | other |
| 1057 | Bergstrom et al. | 1 | 2 | lumbar spine | L2-L4 | primary | dexa |
| 1057 | Bergstrom et al. | 1 | 3 | femoral neck | | primary | dexa |
| 1057 | Bergstrom et al. | 1 | 4 | muscular strength-lower | | secondary | other |
| 744 | Bocalini et al. | 1 | 1 | femoral neck | | primary | dexa |
| 744 | Bocalini et al. | 1 | 2 | lumbar spine | L1-L4 | primary | dexa |
| 744 | Bocalini et al. | 1 | 3 | muscular strength-lower | | secondary | other |
| 744 | Bocalini et al. | 1 | 4 | muscular strength-upper | | secondary | other |
| 744 | Bocalini et al. | 1 | 5 | body weight | | secondary | other |
| 744 | Bocalini et al. | 1 | 6 | body mass index | | secondary | other |
| 744 | Bocalini et al. | 1 | 7 | percent body fat | | secondary | other |
| 1170 | Brentano et al. | 1 | 1 | body weight | | secondary | |
| 1170 | Brentano et al. | 1 | 2 | other | fat mass | secondary | |
| 1170 | Brentano et al. | 1 | 3 | aerobic fitness | | secondary | other |
| 1170 | Brentano et al. | 1 | 4 | aerobic fitness | | secondary | other |
| 1170 | Brentano et al. | 1 | 5 | muscular strength-upper | | secondary | other |
| 1170 | Brentano et al. | 1 | 6 | muscular strength-lower | | secondary | other |
| 1170 | Brentano et al. | 1 | 7 | muscular strength | | secondary | other |
| 1170 | Brentano et al. | 1 | 8 | lumbar spine | L2-L4 | primary | dexa |
| 1170 | Brentano et al. | 1 | 9 | femoral neck | | primary | dexa |
| 1170 | Brentano et al. | 1 | 10 | trochanter(ic) | | secondary | dexa |
| 1170 | Brentano et al. | 1 | 11 | ward's triangle | | secondary | dexa |
| 1170 | Brentano et al. | 1 | 12 | intertrochanter(ic) | | secondary | dexa |
| 1170 | Brentano et al. | 2 | 1 | body weight | | secondary | |
| 1170 | Brentano et al. | 2 | 2 | other | fat mass | secondary | |
| 1170 | Brentano et al. | 2 | 3 | aerobic fitness | | secondary | other |
| 1170 | Brentano et al. | 2 | 4 | aerobic fitness | | secondary | other |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1170 | Brentano et al. | 2 | 5 | muscular strength-upper | | secondary | other |
| 1170 | Brentano et al. | 2 | 6 | muscular strength-lower | | secondary | other |
| 1170 | Brentano et al. | 2 | 7 | muscular strength | | secondary | other |
| 1170 | Brentano et al. | 2 | 8 | lumbar spine | L2-L4 | primary | dexa |
| 1170 | Brentano et al. | 2 | 9 | femoral neck | | primary | dexa |
| 1170 | Brentano et al. | 2 | 10 | trochanter(ic) | | secondary | dexa |
| 1170 | Brentano et al. | 2 | 11 | ward's triangle | | secondary | dexa |
| 1170 | Brentano et al. | 2 | 12 | intertrochanter(ic) | | secondary | dexa |
| 26 | Brooke-Wavell et al. | 1 | 1 | lumbar spine | L2-L4 | primary | dexa |
| 26 | Brooke-Wavell et al. | 1 | 2 | femoral neck | | primary | dexa |
| 26 | Brooke-Wavell et al. | 1 | 3 | calcaneus | | secondary | dexa |
| 26 | Brooke-Wavell et al. | 1 | 4 | body weight | | secondary | |
| 26 | Brooke-Wavell et al. | 1 | 5 | body mass index | | secondary | |
| 26 | Brooke-Wavell et al. | 1 | 6 | calcium intake | | secondary | |
| 362 | Chilibeck et al. | 1 | 1 | body weight | | secondary | other |
| 362 | Chilibeck et al. | 1 | 2 | body mass index | | secondary | other |
| 362 | Chilibeck et al. | 1 | 3 | percent body fat | | secondary | dexa |
| 362 | Chilibeck et al. | 1 | 4 | calcium intake | | secondary | other |
| 362 | Chilibeck et al. | 1 | 5 | vitamin D intake | | secondary | other |
| 362 | Chilibeck et al. | 1 | 6 | lumbar spine | L1-L4 | primary | dexa |
| 362 | Chilibeck et al. | 1 | 7 | femur-proximal | | secondary | dexa |
| 362 | Chilibeck et al. | 1 | 8 | femoral neck | | primary | dexa |
| 362 | Chilibeck et al. | 1 | 9 | trochanter(ic) | | secondary | dexa |
| 362 | Chilibeck et al. | 1 | 10 | ward's triangle | | secondary | dexa |
| 362 | Chilibeck et al. | 1 | 11 | whole body | | secondary | dexa |
| 362 | Chilibeck et al. | 1 | 12 | muscular strength-upper | | secondary | other |
| 362 | Chilibeck et al. | 1 | 13 | muscular strength-lower | | secondary | other |
| 1085 | Choquette et al. | 1 | 1 | body weight | | secondary | other |
| 1085 | Choquette et al. | 1 | 2 | body mass index | | secondary | other |
| 1085 | Choquette et al. | 1 | 3 | other | fat mass | secondary | dexa |
| 1085 | Choquette et al. | 1 | 4 | lean body mass | | secondary | dexa |
| 1085 | Choquette et al. | 1 | 5 | percent body fat | | secondary | dexa |
| 1085 | Choquette et al. | 1 | 6 | whole body | | secondary | dexa |
| 1085 | Choquette et al. | 1 | 7 | lumbar spine | L2-L4 | primary | dexa |
| 1085 | Choquette et al. | 1 | 8 | hip-total | | secondary | dexa |
| 1085 | Choquette et al. | 1 | 9 | femoral neck | | primary | dexa |
| 1085 | Choquette et al. | 1 | 10 | trochanter(ic) | | secondary | dexa |
| 1085 | Choquette et al. | 1 | 11 | ward's triangle | | secondary | dexa |
| 405 | Englund et al. | 1 | 1 | body weight | | secondary | other |
| 405 | Englund et al. | 1 | 2 | body mass index | | secondary | other |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 405 | Englund et al. | 1 | 3 | lean body mass | | secondary | dexa |
| 405 | Englund et al. | 1 | 4 | whole body | | secondary | dexa |
| 405 | Englund et al. | 1 | 5 | arm | | secondary | dexa |
| 405 | Englund et al. | 1 | 6 | lumbar spine | | primary | dexa |
| 405 | Englund et al. | 1 | 7 | femoral neck | | primary | dexa |
| 405 | Englund et al. | 1 | 8 | trochanter(ic) | | secondary | dexa |
| 405 | Englund et al. | 1 | 9 | ward's triangle | | secondary | dexa |
| 405 | Englund et al. | 1 | 10 | muscular strength | | secondary | other |
| 405 | Englund et al. | 1 | 11 | muscular strength | | secondary | other |
| 405 | Englund et al. | 1 | 12 | aerobic fitness | | secondary | other |
| 405 | Englund et al. | 1 | 13 | balance-static | | secondary | other |
| 405 | Englund et al. | 1 | 14 | balance | | secondary | other |
| 407 | Friedlander et al. | 1 | 1 | body weight | | secondary | other |
| 407 | Friedlander et al. | 1 | 2 | percent body fat | | secondary | other |
| 407 | Friedlander et al. | 1 | 3 | lumbar spine | | primary | dexa |
| 407 | Friedlander et al. | 1 | 4 | femoral neck | | primary | dexa |
| 407 | Friedlander et al. | 1 | 5 | trochanter(ic) | | secondary | dexa |
| 407 | Friedlander et al. | 1 | 6 | aerobic fitness | | secondary | other |
| 407 | Friedlander et al. | 1 | 7 | muscular strength-lower | | secondary | other |
| 407 | Friedlander et al. | 1 | 8 | muscular strength-lower | | secondary | other |
| 407 | Friedlander et al. | 1 | 9 | muscular strength-upper | | secondary | other |
| 407 | Friedlander et al. | 1 | 10 | muscular strength-upper | | secondary | other |
| 161 | Going et al. | 1 | 1 | body weight | | secondary | other |
| 161 | Going et al. | 1 | 2 | body mass index | | secondary | other |
| 161 | Going et al. | 1 | 3 | lean body mass | | secondary | dexa |
| 161 | Going et al. | 1 | 4 | percent body fat | | secondary | dexa |
| 161 | Going et al. | 1 | 5 | femoral neck | | primary | dexa |
| 161 | Going et al. | 1 | 6 | trochanter(ic) | | secondary | dexa |
| 161 | Going et al. | 1 | 7 | lumbar spine | L2-L4 | primary | dexa |
| 161 | Going et al. | 1 | 8 | whole body | | secondary | dexa |
| 161 | Going et al. | 2 | 1 | body weight | | secondary | other |
| 161 | Going et al. | 2 | 2 | body mass index | | secondary | other |
| 161 | Going et al. | 2 | 3 | lean body mass | | secondary | dexa |
| 161 | Going et al. | 2 | 4 | percent body fat | | secondary | dexa |
| 161 | Going et al. | 2 | 5 | femoral neck | | primary | dexa |
| 161 | Going et al. | 2 | 6 | trochanter(ic) | | secondary | dexa |
| 161 | Going et al. | 2 | 7 | lumbar spine | L2-L4 | primary | dexa |
| 161 | Going et al. | 2 | 8 | whole body | | secondary | dexa |
| 71 | Grove & Londeree/Grove | 1 | 1 | lumbar spine | L2-L4 | primary | dpa |
| 71 | Grove & Londeree/Grove | 1 | 2 | body weight | | secondary | |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 71 | Grove & Londeree/Grove | 1 | 3 | percent body fat | | secondary | |
| 71 | Grove & Londeree/Grove | 1 | 4 | lean body mass | | secondary | |
| 71 | Grove & Londeree/Grove | 1 | 5 | aerobic fitness | | secondary | |
| 71 | Grove & Londeree/Grove | 1 | 6 | calcium intake | | secondary | |
| 71 | Grove & Londeree/Grove | 2 | 1 | lumbar spine | L2-L4 | primary | dpa |
| 71 | Grove & Londeree/Grove | 2 | 2 | body weight | | secondary | |
| 71 | Grove & Londeree/Grove | 2 | 3 | percent body fat | | secondary | |
| 71 | Grove & Londeree/Grove | 2 | 4 | lean body mass | | secondary | |
| 71 | Grove & Londeree/Grove | 2 | 5 | aerobic fitness | | secondary | |
| 71 | Grove & Londeree/Grove | 2 | 6 | calcium intake | | secondary | |
| 21 | Heinonen et al. | 1 | 1 | lumbar spine | | primary | dexa |
| 21 | Heinonen et al. | 1 | 2 | femoral neck | | primary | dexa |
| 21 | Heinonen et al. | 1 | 3 | trochanter(ic) | | secondary | dexa |
| 21 | Heinonen et al. | 1 | 4 | femur-distal | | secondary | dexa |
| 21 | Heinonen et al. | 1 | 5 | patella | | secondary | dexa |
| 21 | Heinonen et al. | 1 | 6 | tibia-proximal | | secondary | dexa |
| 21 | Heinonen et al. | 1 | 7 | calcaneus | | secondary | dexa |
| 21 | Heinonen et al. | 1 | 8 | radius-distal | | secondary | dexa |
| 21 | Heinonen et al. | 1 | 9 | body weight | | secondary | |
| 21 | Heinonen et al. | 1 | 10 | body mass index | | secondary | |
| 21 | Heinonen et al. | 1 | 11 | percent body fat | | secondary | |
| 21 | Heinonen et al. | 1 | 12 | lean body mass | | secondary | |
| 21 | Heinonen et al. | 1 | 13 | aerobic fitness | | secondary | |
| 21 | Heinonen et al. | 1 | 14 | calcium intake | | secondary | |
| 21 | Heinonen et al. | 1 | 15 | muscular strength | trunk | secondary | |
| 21 | Heinonen et al. | 1 | 16 | muscular strength | trunk | secondary | |
| 21 | Heinonen et al. | 1 | 17 | muscular strength-lower | | secondary | |
| 21 | Heinonen et al. | 1 | 18 | muscular strength-upper | | secondary | |
| 21 | Heinonen et al. | 1 | 19 | muscular power-lower | | secondary | |
| 21 | Heinonen et al. | 1 | 20 | muscular power-lower | | secondary | |
| 21 | Heinonen et al. | 1 | 21 | balance-dynamic | | secondary | |
| 951 | Heinonen et al. | 1 | 1 | lumbar spine | | primary | dexa |
| 951 | Heinonen et al. | 1 | 2 | femoral neck | | primary | dexa |
| 951 | Heinonen et al. | 1 | 3 | calcaneus | | secondary | dexa |
| 951 | Heinonen et al. | 1 | 4 | radius-distal | | secondary | dexa |
| 951 | Heinonen et al. | 1 | 5 | body weight | | secondary | |
| 951 | Heinonen et al. | 1 | 6 | body mass index | | secondary | |
| 951 | Heinonen et al. | 1 | 7 | percent body fat | | secondary | |
| 951 | Heinonen et al. | 1 | 8 | lean body mass | | secondary | |
| 951 | Heinonen et al. | 1 | 9 | calcium intake | | secondary | |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 951 | Heinonen et al. | 1 | 10 | muscular strength-upper | trunk extension | secondary | |
| 951 | Heinonen et al. | 1 | 11 | muscular strength-upper | trunk flexion | secondary | |
| 951 | Heinonen et al. | 1 | 12 | muscular strength-lower | leg press | secondary | |
| 951 | Heinonen et al. | 1 | 13 | muscular strength-upper | elbow flexion | secondary | |
| 951 | Heinonen et al. | 1 | 14 | aerobic fitness | | secondary | |
| 951 | Heinonen et al. | 2 | 1 | lumbar spine | | primary | dexa |
| 951 | Heinonen et al. | 2 | 2 | femoral neck | | primary | dexa |
| 951 | Heinonen et al. | 2 | 3 | calcaneus | | secondary | dexa |
| 951 | Heinonen et al. | 2 | 4 | radius-distal | | secondary | dexa |
| 951 | Heinonen et al. | 2 | 5 | body weight | | secondary | |
| 951 | Heinonen et al. | 2 | 6 | body mass index | | secondary | |
| 951 | Heinonen et al. | 2 | 7 | percent body fat | | secondary | |
| 951 | Heinonen et al. | 2 | 8 | calcium intake | | secondary | |
| 951 | Heinonen et al. | 2 | 9 | muscular strength-upper | trunk extension | secondary | |
| 951 | Heinonen et al. | 2 | 10 | muscular strength-upper | trunk flexion | secondary | |
| 951 | Heinonen et al. | 2 | 11 | muscular strength-lower | leg press | secondary | |
| 951 | Heinonen et al. | 2 | 12 | muscular strength-upper | elbow flexion | secondary | |
| 951 | Heinonen et al. | 2 | 13 | aerobic fitness | | secondary | |
| 1019 | Hong | 1 | 1 | hip-total | | secondary | dexa |
| 1019 | Hong | 1 | 2 | femoral neck | | primary | dexa |
| 1019 | Hong | 1 | 3 | intertrochanter(ic) | | secondary | dexa |
| 1019 | Hong | 1 | 4 | lumbar spine | L2-L4 | primary | dexa |
| 1019 | Hong | 1 | 5 | body weight | | secondary | other |
| 1019 | Hong | 1 | 6 | body mass index | | secondary | other |
| 1019 | Hong | 1 | 7 | muscular strength-upper | | secondary | other |
| 1019 | Hong | 1 | 8 | muscular strength-lower | | secondary | other |
| 1019 | Hong | 1 | 9 | balance-static | | secondary | other |
| 1019 | Hong | 1 | 10 | balance-static | | secondary | other |
| 1019 | Hong | 1 | 11 | balance-static | | secondary | other |
| 1019 | Hong | 1 | 12 | lean body mass | | secondary | dexa |
| 1019 | Hong | 2 | 1 | hip-total | | secondary | dexa |
| 1019 | Hong | 2 | 2 | femoral neck | | primary | dexa |
| 1019 | Hong | 2 | 3 | intertrochanter(ic) | | secondary | dexa |
| 1019 | Hong | 2 | 4 | lumbar spine | L2-L4 | primary | dexa |
| 1019 | Hong | 2 | 5 | body weight | | secondary | other |
| 1019 | Hong | 2 | 6 | body mass index | | secondary | other |
| 1019 | Hong | 2 | 7 | muscular strength-upper | | secondary | other |
| 1019 | Hong | 2 | 8 | muscular strength-lower | | secondary | other |
| 1019 | Hong | 2 | 9 | balance-static | | secondary | other |
| 1019 | Hong | 2 | 10 | balance-static | | secondary | other |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1019 | Hong | 2 | 11 | balance-static | | secondary | other |
| 1019 | Hong | 2 | 12 | lean body mass | | secondary | dexa |
| 1019 | Hong | 3 | 1 | hip-total | | secondary | dexa |
| 1019 | Hong | 3 | 2 | femoral neck | | primary | dexa |
| 1019 | Hong | 3 | 3 | intertrochanter(ic) | | secondary | dexa |
| 1019 | Hong | 3 | 4 | lumbar spine | L2-L4 | primary | dexa |
| 1019 | Hong | 3 | 5 | body weight | | secondary | other |
| 1019 | Hong | 3 | 6 | body mass index | | secondary | other |
| 1019 | Hong | 3 | 7 | muscular strength-upper | | secondary | other |
| 1019 | Hong | 3 | 8 | muscular strength-lower | | secondary | other |
| 1019 | Hong | 3 | 9 | balance-static | | secondary | other |
| 1019 | Hong | 3 | 10 | balance-static | | secondary | other |
| 1019 | Hong | 3 | 11 | balance-static | | secondary | other |
| 1019 | Hong | 3 | 12 | lean body mass | | secondary | dexa |
| 1019 | Hong | 4 | 1 | hip-total | | secondary | dexa |
| 1019 | Hong | 4 | 2 | femoral neck | | primary | dexa |
| 1019 | Hong | 4 | 3 | intertrochanter(ic) | | secondary | dexa |
| 1019 | Hong | 4 | 4 | lumbar spine | L2-L4 | primary | dexa |
| 1019 | Hong | 4 | 5 | body weight | | secondary | other |
| 1019 | Hong | 4 | 6 | body mass index | | secondary | other |
| 1019 | Hong | 4 | 7 | muscular strength-upper | | secondary | other |
| 1019 | Hong | 4 | 8 | muscular strength-lower | | secondary | other |
| 1019 | Hong | 4 | 9 | balance-static | | secondary | other |
| 1019 | Hong | 4 | 10 | balance-static | | secondary | other |
| 1019 | Hong | 4 | 11 | balance-static | | secondary | other |
| 1019 | Hong | 4 | 12 | lean body mass | | secondary | dexa |
| 135 | Iwamoto et al. | 1 | 1 | body weight | | secondary | other |
| 135 | Iwamoto et al. | 1 | 2 | body mass index | | secondary | other |
| 135 | Iwamoto et al. | 1 | 3 | lumbar spine | L2-L4 | primary | dexa |
| 819 | Jessup et al. | 1 | 1 | femoral neck | | primary | dexa |
| 819 | Jessup et al. | 1 | 2 | lumbar spine | | primary | dexa |
| 819 | Jessup et al. | 1 | 3 | balance-static | | secondary | dexa |
| 819 | Jessup et al. | 1 | 4 | muscular strength | | secondary | other |
| 819 | Jessup et al. | 1 | 5 | body weight | | secondary | other |
| 827 | Kemmler et al. | 1 | 1 | body weight | | secondary | other |
| 827 | Kemmler et al. | 1 | 2 | percent body fat | | secondary | dexa |
| 827 | Kemmler et al. | 1 | 3 | calcium intake | | secondary | other |
| 827 | Kemmler et al. | 1 | 4 | aerobic fitness | | secondary | other |
| 827 | Kemmler et al. | 1 | 5 | lumbar spine | | primary | dexa |
| 827 | Kemmler et al. | 1 | 6 | femoral neck | | primary | dexa |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 827 | Kemmler et al. | 1 | 7 | fractures | | secondary | other |
| 205 | Kerr et al. | 1 | 1 | body weight | | secondary | other |
| 205 | Kerr et al. | 1 | 2 | whole body | | secondary | dexa |
| 205 | Kerr et al. | 1 | 3 | percent body fat | | secondary | |
| 205 | Kerr et al. | 1 | 4 | lean body mass | | secondary | |
| 205 | Kerr et al. | 1 | 5 | trochanter(ic) | | secondary | dexa |
| 205 | Kerr et al. | 1 | 6 | intertrochanter(ic) | | secondary | dexa |
| 205 | Kerr et al. | 1 | 7 | femoral neck | | primary | dexa |
| 205 | Kerr et al. | 1 | 8 | ward's triangle | | secondary | dexa |
| 205 | Kerr et al. | 1 | 9 | radius-ultra-distal | | secondary | dexa |
| 205 | Kerr et al. | 1 | 10 | radius-mid | | secondary | dexa |
| 205 | Kerr et al. | 1 | 11 | radius-1/3 | | secondary | dexa |
| 205 | Kerr et al. | 1 | 12 | muscular strength-lower | hip extension | secondary | other |
| 205 | Kerr et al. | 1 | 13 | muscular strength-lower | hip flexion | secondary | other |
| 205 | Kerr et al. | 1 | 14 | muscular strength-lower | hip abduction | secondary | other |
| 205 | Kerr et al. | 1 | 15 | muscular strength-lower | hip adduction | secondary | other |
| 205 | Kerr et al. | 1 | 16 | muscular strength-lower | leg press | secondary | other |
| 205 | Kerr et al. | 1 | 17 | muscular strength-upper | wrist curl | secondary | other |
| 205 | Kerr et al. | 1 | 18 | muscular strength-upper | reverse wrist curl | secondary | other |
| 205 | Kerr et al. | 1 | 19 | muscular strength-upper | wrist pronation/supination | secondary | other |
| 205 | Kerr et al. | 1 | 20 | muscular strength-upper | biceps curl | secondary | other |
| 205 | Kerr et al. | 1 | 21 | muscular strength-upper | triceps push down | secondary | other |
| 205 | Kerr et al. | 2 | 1 | body weight | | secondary | other |
| 205 | Kerr et al. | 2 | 2 | whole body | | secondary | dexa |
| 205 | Kerr et al. | 2 | 3 | percent body fat | | secondary | |
| 205 | Kerr et al. | 2 | 4 | lean body mass | | secondary | |
| 205 | Kerr et al. | 2 | 5 | trochanter(ic) | | secondary | dexa |
| 205 | Kerr et al. | 2 | 6 | intertrochanter(ic) | | secondary | dexa |
| 205 | Kerr et al. | 2 | 7 | femoral neck | | primary | dexa |
| 205 | Kerr et al. | 2 | 8 | ward's triangle | | secondary | dexa |
| 205 | Kerr et al. | 2 | 9 | radius-ultra-distal | | secondary | dexa |
| 205 | Kerr et al. | 2 | 10 | radius-mid | | secondary | dexa |
| 205 | Kerr et al. | 2 | 11 | radius-1/3 | | secondary | dexa |
| 205 | Kerr et al. | 2 | 12 | muscular strength-lower | hip extension | secondary | other |
| 205 | Kerr et al. | 2 | 13 | muscular strength-lower | hip flexion | secondary | other |
| 205 | Kerr et al. | 2 | 14 | muscular strength-lower | hip abduction | secondary | other |
| 205 | Kerr et al. | 2 | 15 | muscular strength-lower | hip adduction | secondary | other |
| 205 | Kerr et al. | 2 | 16 | muscular strength-lower | leg press | secondary | other |
| 205 | Kerr et al. | 2 | 17 | muscular strength-upper | wrist curl | secondary | other |
| 205 | Kerr et al. | 2 | 18 | muscular strength-upper | reverse wrist curl | secondary | other |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 205 | Kerr et al. | 2 | 19 | muscular strength-upper | wrist pronation/supination | secondary | other |
| 205 | Kerr et al. | 2 | 20 | muscular strength-upper | biceps curl | secondary | other |
| 205 | Kerr et al. | 2 | 21 | muscular strength-upper | triceps push down | secondary | other |
| 322 | Kerr et al. | 1 | 1 | body weight | | secondary | other |
| 322 | Kerr et al. | 1 | 2 | percent body fat | | secondary | other |
| 322 | Kerr et al. | 1 | 3 | lean body mass | | secondary | other |
| 322 | Kerr et al. | 1 | 4 | lumbar spine | L1-L4 | primary | dexa |
| 322 | Kerr et al. | 1 | 5 | hip-total | | secondary | dexa |
| 322 | Kerr et al. | 1 | 6 | trochanter(ic) | | secondary | dexa |
| 322 | Kerr et al. | 1 | 7 | intertrochanter(ic) | | secondary | dexa |
| 322 | Kerr et al. | 1 | 8 | femoral neck | | primary | dexa |
| 322 | Kerr et al. | 1 | 9 | radius-ultra-distal | | secondary | dexa |
| 322 | Kerr et al. | 1 | 10 | radius-mid | | secondary | dexa |
| 322 | Kerr et al. | 1 | 11 | radius-1/3 | | secondary | dexa |
| 322 | Kerr et al. | 1 | 12 | whole body | | secondary | dexa |
| 322 | Kerr et al. | 2 | 1 | body weight | | secondary | other |
| 322 | Kerr et al. | 2 | 2 | percent body fat | | secondary | other |
| 322 | Kerr et al. | 2 | 3 | lean body mass | | secondary | other |
| 322 | Kerr et al. | 2 | 4 | lumbar spine | L1-L4 | primary | dexa |
| 322 | Kerr et al. | 2 | 5 | hip-total | | secondary | dexa |
| 322 | Kerr et al. | 2 | 6 | trochanter(ic) | | secondary | dexa |
| 322 | Kerr et al. | 2 | 7 | intertrochanter(ic) | | secondary | dexa |
| 322 | Kerr et al. | 2 | 8 | femoral neck | | primary | dexa |
| 322 | Kerr et al. | 2 | 9 | radius-ultra-distal | | secondary | dexa |
| 322 | Kerr et al. | 2 | 10 | radius-mid | | secondary | dexa |
| 322 | Kerr et al. | 2 | 11 | radius-1/3 | | secondary | dexa |
| 322 | Kerr et al. | 2 | 12 | whole body | | secondary | dexa |
| 1113 | Kukuljan et al. | 1 | 1 | body weight | | secondary | other |
| 1113 | Kukuljan et al. | 1 | 2 | body mass index | | secondary | other |
| 1113 | Kukuljan et al. | 1 | 3 | calcium intake | | secondary | other |
| 1113 | Kukuljan et al. | 1 | 4 | vitamin D intake | | secondary | other |
| 1113 | Kukuljan et al. | 1 | 5 | lumbar spine | L1-L4 | primary | dexa |
| 1113 | Kukuljan et al. | 1 | 6 | femoral neck | | primary | dexa |
| 1113 | Kukuljan et al. | 1 | 7 | hip-total | | secondary | dexa |
| 1113 | Kukuljan et al. | 2 | 1 | body weight | | secondary | other |
| 1113 | Kukuljan et al. | 2 | 2 | body mass index | | secondary | other |
| 1113 | Kukuljan et al. | 2 | 3 | calcium intake | | secondary | other |
| 1113 | Kukuljan et al. | 2 | 4 | vitamin D intake | | secondary | other |
| 1113 | Kukuljan et al. | 2 | 5 | lumbar spine | L1-L4 | primary | dexa |
| 1113 | Kukuljan et al. | 2 | 6 | femoral neck | | primary | dexa |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1113 | Kukuljan et al. | 2 | 7 | hip-total | | secondary | dexa |
| 1118 | Liang et al. | 1 | 1 | body weight | | secondary | other |
| 1118 | Liang et al. | 1 | 2 | body mass index | | secondary | other |
| 1118 | Liang et al. | 1 | 3 | aerobic fitness | | secondary | other |
| 1118 | Liang et al. | 1 | 4 | os calcis | | secondary | dexa |
| 1118 | Liang et al. | 1 | 5 | wrist | | secondary | dexa |
| 1118 | Liang et al. | 1 | 6 | lower limb | | secondary | dexa |
| 1118 | Liang et al. | 1 | 7 | hip-total | | secondary | dexa |
| 1118 | Liang et al. | 1 | 8 | femoral neck | | primary | dexa |
| 1118 | Liang et al. | 1 | 9 | trochanter(ic) | | secondary | dexa |
| 1118 | Liang et al. | 1 | 10 | ward's triangle | | secondary | dexa |
| 1118 | Liang et al. | 1 | 11 | lumbar spine | L1-L4 | primary | dexa |
| 1118 | Liang et al. | 1 | 12 | percent body fat | | secondary | dexa |
| 1118 | Liang et al. | 1 | 13 | lean body mass | | secondary | dexa |
| 1118 | Liang et al. | 1 | 14 | calcium intake | | secondary | other |
| 1118 | Liang et al. | 1 | 15 | muscular strength-lower | | secondary | other |
| 1118 | Liang et al. | 2 | 1 | body weight | | secondary | other |
| 1118 | Liang et al. | 2 | 2 | body mass index | | secondary | other |
| 1118 | Liang et al. | 2 | 3 | aerobic fitness | | secondary | other |
| 1118 | Liang et al. | 2 | 4 | os calcis | | secondary | dexa |
| 1118 | Liang et al. | 2 | 5 | wrist | | secondary | dexa |
| 1118 | Liang et al. | 2 | 6 | lower limb | | secondary | dexa |
| 1118 | Liang et al. | 2 | 7 | hip-total | | secondary | dexa |
| 1118 | Liang et al. | 2 | 8 | femoral neck | | primary | dexa |
| 1118 | Liang et al. | 2 | 9 | trochanter(ic) | | secondary | dexa |
| 1118 | Liang et al. | 2 | 10 | ward's triangle | | secondary | dexa |
| 1118 | Liang et al. | 2 | 11 | lumbar spine | L1-L4 | primary | dexa |
| 1118 | Liang et al. | 2 | 12 | percent body fat | | secondary | dexa |
| 1118 | Liang et al. | 2 | 13 | lean body mass | | secondary | dexa |
| 1118 | Liang et al. | 2 | 14 | calcium intake | | secondary | other |
| 1118 | Liang et al. | 2 | 15 | muscular strength-lower | | secondary | other |
| 85 | Liu-Ambrose et al. | 1 | 1 | body weight | | secondary | |
| 85 | Liu-Ambrose et al. | 1 | 2 | lean body mass | | secondary | dexa |
| 85 | Liu-Ambrose et al. | 1 | 3 | other | fat mass | secondary | dexa |
| 85 | Liu-Ambrose et al. | 1 | 4 | hip-total | | secondary | dexa |
| 85 | Liu-Ambrose et al. | 1 | 5 | femoral neck | | primary | dexa |
| 85 | Liu-Ambrose et al. | 1 | 6 | trochanter(ic) | | secondary | dexa |
| 85 | Liu-Ambrose et al. | 1 | 7 | other | tibia - cortical content (50% | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 8 | other | tibia - cortical area (50% tib | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 9 | other | tibia - cortical density | secondary | pqct |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 85 | Liu-Ambrose et al. | 1 | 10 | other | tibia - stress strain index (50 | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 11 | other | tibia - total content (10% tib | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 12 | other | tibia - total area (10% tibia) | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 13 | other | tibia - total density (10% tib | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 14 | other | radius - cortical content (30 | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 15 | other | radius - cortical area (30% r | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 16 | other | radius - cortical density (30 | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 17 | other | radius - stress strain index ( | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 18 | other | radius - total content (10% r | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 19 | other | radius - total area (10% radi | secondary | pqct |
| 85 | Liu-Ambrose et al. | 1 | 20 | other | radius - total density (10% r | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 1 | body weight | | secondary | |
| 85 | Liu-Ambrose et al. | 2 | 2 | lean body mass | | secondary | dexa |
| 85 | Liu-Ambrose et al. | 2 | 3 | other | fat mass | secondary | dexa |
| 85 | Liu-Ambrose et al. | 2 | 4 | hip-total | | secondary | dexa |
| 85 | Liu-Ambrose et al. | 2 | 5 | femoral neck | | primary | dexa |
| 85 | Liu-Ambrose et al. | 2 | 6 | trochanter(ic) | | secondary | dexa |
| 85 | Liu-Ambrose et al. | 2 | 7 | other | tibia - cortical content (50% | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 8 | other | tibia - cortical area (50% tib | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 9 | other | tibia - cortical density | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 10 | other | tibia - stress strain index (50 | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 11 | other | tibia - total content (10% tib | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 12 | other | tibia - total area (10% tibia) | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 13 | other | tibia - total density (10% tib | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 14 | other | radius - cortical content (30 | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 15 | other | radius - cortical area (30% r | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 16 | other | radius - cortical density (30 | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 17 | other | radius - stress strain index ( | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 18 | other | radius - total content (10% r | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 19 | other | radius - total area (10% radi | secondary | pqct |
| 85 | Liu-Ambrose et al. | 2 | 20 | other | radius - total density (10% r | secondary | pqct |
| 184 | Lohman et al. | 1 | 1 | whole body | | secondary | dexa |
| 184 | Lohman et al. | 1 | 2 | lumbar spine | l2-l4 | primary | dexa |
| 184 | Lohman et al. | 1 | 3 | femoral neck | | primary | dexa |
| 184 | Lohman et al. | 1 | 4 | trochanter(ic) | | secondary | dexa |
| 184 | Lohman et al. | 1 | 5 | ward's triangle | | secondary | dexa |
| 184 | Lohman et al. | 1 | 6 | radius | | secondary | dexa |
| 184 | Lohman et al. | 1 | 7 | body weight | | secondary | |
| 184 | Lohman et al. | 1 | 8 | body mass index | | secondary | |
| 184 | Lohman et al. | 1 | 9 | percent body fat | | secondary | |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 184 | Lohman et al. | 1 | 10 | lean body mass | | secondary | |
| 1120 | Marques et al. | 1 | 1 | calcium intake | | secondary | other |
| 1120 | Marques et al. | 1 | 2 | vitamin D intake | | secondary | other |
| 1120 | Marques et al. | 1 | 3 | body mass index | | secondary | other |
| 1120 | Marques et al. | 1 | 4 | lean body mass | | secondary | dexa |
| 1120 | Marques et al. | 1 | 5 | percent body fat | | secondary | dexa |
| 1120 | Marques et al. | 1 | 6 | balance-dynamic | | secondary | other |
| 1120 | Marques et al. | 1 | 7 | balance-static | | secondary | other |
| 1120 | Marques et al. | 1 | 8 | muscular strength-lower | | secondary | other |
| 1120 | Marques et al. | 1 | 9 | muscular strength-lower | | secondary | other |
| 1120 | Marques et al. | 1 | 10 | muscular strength-lower | | secondary | other |
| 1120 | Marques et al. | 1 | 11 | muscular strength-lower | | secondary | other |
| 1120 | Marques et al. | 1 | 12 | femoral neck | | primary | dexa |
| 1120 | Marques et al. | 1 | 13 | trochanter(ic) | | secondary | dexa |
| 1120 | Marques et al. | 1 | 14 | intertrochanter(ic) | | secondary | dexa |
| 1120 | Marques et al. | 1 | 15 | hip-total | | secondary | dexa |
| 1120 | Marques et al. | 2 | 1 | calcium intake | | secondary | other |
| 1120 | Marques et al. | 2 | 2 | vitamin D intake | | secondary | other |
| 1120 | Marques et al. | 2 | 3 | body mass index | | secondary | other |
| 1120 | Marques et al. | 2 | 4 | lean body mass | | secondary | dexa |
| 1120 | Marques et al. | 2 | 5 | percent body fat | | secondary | dexa |
| 1120 | Marques et al. | 2 | 6 | balance-dynamic | | secondary | other |
| 1120 | Marques et al. | 2 | 7 | balance-static | | secondary | other |
| 1120 | Marques et al. | 2 | 8 | muscular strength-lower | | secondary | other |
| 1120 | Marques et al. | 2 | 9 | muscular strength-lower | | secondary | other |
| 1120 | Marques et al. | 2 | 10 | muscular strength-lower | | secondary | other |
| 1120 | Marques et al. | 2 | 11 | muscular strength-lower | | secondary | other |
| 1120 | Marques et al. | 2 | 12 | femoral neck | | primary | dexa |
| 1120 | Marques et al. | 2 | 13 | trochanter(ic) | | secondary | dexa |
| 1120 | Marques et al. | 2 | 14 | intertrochanter(ic) | | secondary | dexa |
| 1120 | Marques et al. | 2 | 15 | hip-total | | secondary | dexa |
| 1121 | Marques et al. | 1 | 1 | calcium intake | | secondary | other |
| 1121 | Marques et al. | 1 | 2 | vitamin D intake | | secondary | other |
| 1121 | Marques et al. | 1 | 3 | body mass index | | secondary | other |
| 1121 | Marques et al. | 1 | 4 | percent body fat | | secondary | dexa |
| 1121 | Marques et al. | 1 | 5 | lean body mass | | secondary | dexa |
| 1121 | Marques et al. | 1 | 6 | aerobic fitness | | secondary | other |
| 1121 | Marques et al. | 1 | 7 | muscular strength-upper | | secondary | other |
| 1121 | Marques et al. | 1 | 8 | balance-dynamic | | secondary | other |
| 1121 | Marques et al. | 1 | 9 | balance-static | | secondary | other |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1121 | Marques et al. | 1 | 10 | muscular strength-lower | | secondary | other |
| 1121 | Marques et al. | 1 | 11 | muscular strength-lower | | secondary | other |
| 1121 | Marques et al. | 1 | 12 | muscular strength-lower | | secondary | other |
| 1121 | Marques et al. | 1 | 13 | muscular strength-lower | | secondary | other |
| 1121 | Marques et al. | 1 | 14 | muscular strength-lower | | secondary | other |
| 1121 | Marques et al. | 1 | 15 | muscular strength-lower | | secondary | other |
| 1121 | Marques et al. | 1 | 16 | muscular strength-lower | | secondary | other |
| 1121 | Marques et al. | 1 | 17 | muscular strength-lower | | secondary | other |
| 1121 | Marques et al. | 1 | 18 | muscular strength-lower | | secondary | other |
| 1121 | Marques et al. | 1 | 19 | femoral neck | | primary | dexa |
| 1121 | Marques et al. | 1 | 20 | trochanter(ic) | | secondary | dexa |
| 1121 | Marques et al. | 1 | 21 | intertrochanter(ic) | | secondary | dexa |
| 1121 | Marques et al. | 1 | 22 | hip-total | | secondary | dexa |
| 1121 | Marques et al. | 1 | 23 | lumbar spine | L1-L4 | primary | dexa |
| 19 | Martin & Notelovitz | 1 | 1 | lumbar spine | | primary | dpa |
| 19 | Martin & Notelovitz | 1 | 2 | body weight | | secondary | |
| 19 | Martin & Notelovitz | 1 | 3 | body mass index | | secondary | |
| 19 | Martin & Notelovitz | 1 | 4 | aerobic fitness | | secondary | |
| 19 | Martin & Notelovitz | 2 | 1 | lumbar spine | | primary | dpa |
| 19 | Martin & Notelovitz | 2 | 2 | body weight | | secondary | |
| 19 | Martin & Notelovitz | 2 | 3 | body mass index | | secondary | |
| 19 | Martin & Notelovitz | 2 | 4 | aerobic fitness | | secondary | |
| 170 | Nelson et al. | 1 | 1 | femoral neck | | primary | dexa |
| 170 | Nelson et al. | 1 | 2 | lumbar spine | | primary | dexa |
| 170 | Nelson et al. | 1 | 3 | body weight | | secondary | |
| 170 | Nelson et al. | 1 | 4 | body mass index | | secondary | |
| 170 | Nelson et al. | 1 | 5 | calcium intake | | secondary | |
| 170 | Nelson et al. | 1 | 6 | muscular strength-lower | double leg press | secondary | other |
| 170 | Nelson et al. | 1 | 7 | muscular strength-lower | knee extension | secondary | other |
| 170 | Nelson et al. | 1 | 8 | muscular strength-upper | lateral pulldown | secondary | other |
| 170 | Nelson et al. | 1 | 9 | muscular strength-upper | back extension | secondary | other |
| 170 | Nelson et al. | 1 | 10 | muscular strength-upper | abdominal flexion | secondary | other |
| 170 | Nelson et al. | 1 | 11 | balance-dynamic | | secondary | other |
| 170 | Nelson et al. | 1 | 12 | other | physical activity score | secondary | other |
| 863 | Newstead et al. | 1 | 1 | body weight | | secondary | |
| 863 | Newstead et al. | 1 | 2 | body mass index | | secondary | |
| 863 | Newstead et al. | 1 | 3 | femoral neck | | primary | dexa |
| 863 | Newstead et al. | 1 | 4 | hip-total | | secondary | dexa |
| 863 | Newstead et al. | 1 | 5 | lumbar spine | L1-L4 | primary | dexa |
| 365 | Prince et al. | 1 | 1 | spine | | secondary | dexa |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 365 | Prince et al. | 1 | 2 | hip-total | | secondary | dexa |
| 365 | Prince et al. | 1 | 3 | lower limb | | secondary | dexa |
| 365 | Prince et al. | 1 | 4 | trochanter(ic) | | secondary | dexa |
| 365 | Prince et al. | 1 | 5 | intertrochanter(ic) | | secondary | dexa |
| 365 | Prince et al. | 1 | 6 | femoral neck | | primary | dexa |
| 365 | Prince et al. | 1 | 7 | tibia-mid | | secondary | dexa |
| 365 | Prince et al. | 1 | 8 | ultradistal | | secondary | dexa |
| 174 | Rhodes et al. | 1 | 1 | body weight | | secondary | |
| 174 | Rhodes et al. | 1 | 2 | femoral neck | | primary | dexa |
| 174 | Rhodes et al. | 1 | 3 | ward's triangle | | secondary | dexa |
| 174 | Rhodes et al. | 1 | 4 | trochanter(ic) | | secondary | dexa |
| 174 | Rhodes et al. | 1 | 5 | lumbar spine | L2-L4 | primary | dexa |
| 174 | Rhodes et al. | 1 | 6 | muscular strength-upper | | secondary | other |
| 174 | Rhodes et al. | 1 | 7 | muscular strength-upper | bench press | secondary | other |
| 174 | Rhodes et al. | 1 | 8 | muscular strength-lower | leg press | secondary | other |
| 174 | Rhodes et al. | 1 | 9 | muscular strength-upper | biceps curl | secondary | other |
| 174 | Rhodes et al. | 1 | 10 | muscular strength-upper | triceps push down | secondary | other |
| 174 | Rhodes et al. | 1 | 11 | muscular strength-lower | quadriceps curl | secondary | other |
| 30 | Villareal et al. | 1 | 1 | body mass index | | secondary | other |
| 30 | Villareal et al. | 1 | 2 | aerobic fitness | | secondary | other |
| 30 | Villareal et al. | 1 | 3 | body weight | | secondary | other |
| 30 | Villareal et al. | 1 | 4 | lean body mass | | secondary | dexa |
| 30 | Villareal et al. | 1 | 5 | other | fat mass | secondary | dexa |
| 30 | Villareal et al. | 1 | 6 | hip-total | | secondary | dexa |
| 30 | Villareal et al. | 1 | 7 | muscular strength | | secondary | other |
| 30 | Villareal et al. | 1 | 8 | balance-dynamic | | secondary | other |
| 30 | Villareal et al. | 1 | 9 | balance-static | | secondary | other |
| 30 | Villareal et al. | 1 | 10 | whole body | | secondary | dexa |
| 30 | Villareal et al. | 1 | 11 | lumbar spine | | primary | dexa |
| 913 | Villareal et al. | 1 | 1 | body weight | | secondary | |
| 913 | Villareal et al. | 1 | 2 | aerobic fitness | | secondary | |
| 913 | Villareal et al. | 1 | 3 | hip-total | | secondary | dexa |
| 913 | Villareal et al. | 1 | 4 | trochanter(ic) | | secondary | dexa |
| 913 | Villareal et al. | 1 | 5 | femoral neck | | primary | dexa |
| 913 | Villareal et al. | 1 | 6 | lumbar spine | L2-L4 | primary | dexa |
| 913 | Villareal et al. | 1 | 7 | whole body | | secondary | dexa |
| 913 | Villareal et al. | 1 | 8 | calcium intake | | secondary | |
| 913 | Villareal et al. | 1 | 9 | vitamin D intake | | secondary | |
| 920 | Warren et al. | 1 | 1 | muscular strength-upper | bench press | secondary | other |
| 920 | Warren et al. | 1 | 2 | muscular strength-lower | leg press | secondary | other |

Outcome Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **920** | Warren et al. | 1 | 3 | body weight | | secondary | other |
| **920** | Warren et al. | 1 | 4 | other | fat mass | secondary | dexa |
| **920** | Warren et al. | 1 | 5 | lean body mass | | secondary | dexa |
| **920** | Warren et al. | 1 | 6 | trochanter(ic) | | secondary | dexa |
| **920** | Warren et al. | 1 | 7 | femoral neck | | primary | dexa |
| **920** | Warren et al. | 1 | 8 | femur | | secondary | dexa |
| **920** | Warren et al. | 1 | 9 | lumbar spine | | primary | dexa |
| **239** | Weaver et al. | 1 | 1 | aerobic fitness | | secondary | other |
| **239** | Weaver et al. | 1 | 2 | muscular strength | | secondary | other |
| **239** | Weaver et al. | 1 | 3 | lean body mass | | secondary | dexa |
| **239** | Weaver et al. | 1 | 4 | lumbar spine | L2-L4 | primary | dexa |
| **239** | Weaver et al. | 1 | 5 | radius | | secondary | spa |
| **239** | Weaver et al. | 1 | 6 | femoral neck | | primary | dexa |
| **239** | Weaver et al. | 1 | 7 | trochanter(ic)-greater | | secondary | dexa |
| **239** | Weaver et al. | 1 | 8 | ward's triangle | | secondary | dexa |
| **239** | Weaver et al. | 1 | 9 | body weight | | secondary | dexa |
| **239** | Weaver et al. | 1 | 10 | calcium intake | | secondary | other |
| **922** | Westby et al. | 1 | 1 | body weight | | secondary | |
| **922** | Westby et al. | 1 | 2 | lumbar spine | L2-L4 | primary | dexa |
| **922** | Westby et al. | 1 | 3 | femoral neck | | primary | dexa |
| **105** | Wu et al. | 1 | 1 | body weight | | secondary | |
| **105** | Wu et al. | 1 | 2 | body mass index | | secondary | |
| **105** | Wu et al. | 1 | 3 | calcium intake | | secondary | |
| **105** | Wu et al. | 1 | 4 | vitamin D intake | | secondary | |
| **105** | Wu et al. | 1 | 5 | whole body | | secondary | dexa |
| **105** | Wu et al. | 1 | 6 | lean body mass | | secondary | dexa |
| **105** | Wu et al. | 1 | 7 | other | fat mass | secondary | dexa |
| **105** | Wu et al. | 1 | 8 | lumbar spine | L2-L4 | primary | dexa |
| **105** | Wu et al. | 1 | 9 | hip-total | | secondary | dexa |
| **105** | Wu et al. | 1 | 10 | femoral neck | | primary | dexa |
| **105** | Wu et al. | 1 | 11 | trochanter(ic) | | secondary | dexa |
| **930** | Zeilman III | 1 | 1 | body weight | | secondary | other |
| **930** | Zeilman III | 1 | 2 | body mass index | | secondary | other |
| **930** | Zeilman III | 1 | 3 | lumbar spine | L2-L4 | primary | dexa |
| **930** | Zeilman III | 1 | 4 | hip-total | | secondary | dexa |
| **930** | Zeilman III | 1 | 5 | femoral neck | | primary | dexa |

Outcome Characteristics

| outcome_test_desc | reliablity | metric | metric_other |
|---|---|---|---|
| Lunar Prodigy Advance, GE Lunar | 1.4% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy Advance, GE Lunar | 1.8% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy Advance, GE Lunar | 1.3% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy Advance, GE Lunar | 2.3% (coefficient of variation) | gm_cm_2 | |
| light indoor clothing using digital scales | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| | | percentage | |
| Lunar Prodigy Advance, GE Lunar | 1.4% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy Advance, GE Lunar | 1.8% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy Advance, GE Lunar | 1.3% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy Advance, GE Lunar | 2.3% (coefficient of variation) | gm_cm_2 | |
| light indoor clothing using digital scales | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| | | percentage | |
| Lunar Prodigy Advance, GE Lunar | 1.4% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy Advance, GE Lunar | 1.8% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy Advance, GE Lunar | 1.3% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy Advance, GE Lunar | 2.3% (coefficient of variation) | gm_cm_2 | |
| light indoor clothing using digital scales | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| | | percentage | |
| | 1.4% (coefficient of variation) | gm_cm_2 | |
| | 1.4% (coefficient of variation) | gm_cm_2 | |
| | 2.0% (coefficient of variation) | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| | | watts | |
| one foot, 20 seconds, other foot struck two hydraulic switches | | other | |
| | 1.4% (coefficient of variation) | gm_cm_2 | |
| | 1.4% (coefficient of variation) | gm_cm_2 | |
| | 2.0% (coefficient of variation) | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| | | milligrams | |
| | 1.4% (coefficient of variation) | gm_cm_2 | |
| | 1.4% (coefficient of variation) | gm_cm_2 | |
| | 2.0% (coefficient of variation) | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| | | milligrams | |
| one foot, 20 seconds, other foot struck two hydraulic switches | | other | |
| derived from measures of height and weight | | kgmsquared | |
| chair stand test | | other | seconds |
| Lunar Prodigy 10631 GE Medical Systems | 1% (precision) | gm_cm_2 | |
| Lunar Prodigy 10631 GE Medical Systems | 1% (precision) | gm_cm_2 | |
| Lunar Prodigy 10631 GE Medical Systems | | gm_cm_2 | |
| Lunar Prodigy 10631 GE Medical Systems | | gm_cm_2 | |
| chair stand test | | other | seconds |
| Lunar Prodigy 10631 GE Medical Systems | 1% (precision) | gm_cm_2 | |
| Lunar Prodigy 10631 GE Medical Systems | 1% (precision) | gm_cm_2 | |
| Lunar Prodigy 10631 GE Medical Systems | | gm_cm_2 | |
| Lunar Prodigy 10631 GE Medical Systems | | gm_cm_2 | |
| derived from measures of height and weight | | kgmsquared | |
| Hologic | | gm_cm_2 | |
| Hologic | | gm_cm_2 | |
| vertical jump | | centimeters | |
| DEA-DTX 200 Osteometer | | gm_cm_2 | |
| DEA-DTX 200 Osteometer | | gm_cm_2 | |
| 1 RM for lower body strength | | kilograms | |
| 1 RM for upper body strength | | kilograms | |
| | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| calculated using equations from Woo, Ho, and Sham, 2001 | | percentage | |
| | | kilograms | |
| | | kilograms | |
| incremental treadmill test (INBRAMED, 10200ATL) to volitional exhaustion | | mlkgmin | |
| incremental treadmill test (INBRAMED, 10200ATL) to volitional exhaustion | | other | seconds |
| 1RM maximum (arm curl) | | kilograms | |
| 1RM maximum (knee extension) | | kilograms | |
| isometric strength (knee extensors) using an isokinetic dynamometer (Cybex Norm) | | other | newton meters |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| | | kilograms | |
| | | kilograms | |
| incremental treadmill test (INBRAMED, 10200ATL) to volitional exhaustion | | mlkgmin | |
| incremental treadmill test (INBRAMED, 10200ATL) to volitional exhaustion | | other | seconds |

Outcome Characteristics

| | | | |
|---|---|---|---|
| 1RM maximum (arm curl) | | kilograms | |
| 1RM maximum (knee extension) | | kilograms | |
| isometric strength (knee extensors) using an isokinetic dynamometer (Cybex Norm) | | other | newton meters |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| | 1.4 (coefficient of variation) | gm_cm_2 | |
| | 1.9 (coefficient of variation) | gm_cm_2 | |
| | 2.7 (coefficient of variation) | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| | | milligrams | |
| light clothing with shoes off | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| Hologic QDR-2000 | 2.95% (coefficient of variation) | percentage | |
| Food frequency questionnaire; current use of calcium and other nutritional supplements; Block Food Frequency Questionnaire | | milligrams | |
| Food frequency questionnaire; current use of calcium and other nutritional supplements; Block Food Frequency Questionnaire | | other | micrograms |
| Hologic QDR-2000 | 0.7% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR-2000 | 1.0% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR-2000 | | gm_cm_2 | |
| Hologic QDR-2000 | | gm_cm_2 | |
| Hologic QDR-2000 | | gm_cm_2 | |
| Hologic QDR-2000 | 0.5% (coefficient of variation) | gm_cm_2 | |
| 1 RM bench press test | | kilograms | |
| 1 RM leg press test | | kilograms | |
| electronic scale (SECA707) to plus or minus 0.2 kg | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| Lunar Prodigy (GE) | 0.9% (coefficient of variation) | kilograms | |
| Lunar Prodigy (GE) | 0.4% (coefficient of variation) | kilograms | |
| Lunar Prodigy (GE) | 0.4% (coefficient of variation) | percentage | |
| Lunar Prodigy (GE) | 0.1% (coefficient of variation) | gm_cm_2 | |
| Lunar Prodigy (GE) | | gm_cm_2 | |
| Lunar Prodigy (GE) | | gm_cm_2 | |
| Lunar Prodigy (GE) | | gm_cm_2 | |
| Lunar Prodigy (GE) | | gm_cm_2 | |
| Lunar Prodigy (GE) | | gm_cm_2 | |
| standard equipment in stocking feet and underwear | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| Lunar DPX-L | 0.9% (coefficient of variation) | kilograms | |
| Lunar DPX-L | 0.7% (coefficient of variation) | gm_cm_2 | |
| Lunar DPX-L | 1.0% (coefficient of variation) | gm_cm_2 | |
| Lunar DPX-L | 0.6% (coefficient of variation) | gm_cm_2 | |
| Lunar DPX-L | 0.8% (coefficient of variation) | gm_cm_2 | |
| Lunar DPX-L | 1.5% (coefficient of variation) | gm_cm_2 | |
| Lunar DPX-L | 1.2% (coefficient of variation) | gm_cm_2 | |
| 1RM handgrip strength using a tensiometer | | newtons | |
| 1RM knee extensor strength using a tensiometer | | newtons | |
| 30 meter walk | | | meters/second |
| timed standing balance on one leg | | other | seconds |
| Berg Balance Scale | | other | |
| standard height and weight measurements taken | | kilograms | |
| skinfold calipers at biceps, triceps, subscapula, anterior-superior iliac spine | .835 (reliability) | percentage | |
| Hologic QDR-1000 | 1% (precision) | gm_cm_2 | |
| Hologic QDR-1000 | 1-2% (precision) | gm_cm_2 | |
| Hologic QDR-1000 | 1-2% (precision) | gm_cm_2 | |
| Bruce treadmill test using Quinton Q55 treadmill | | mlkgmin | |
| isokinetic knee extension using Cybex340 | 5.5% (reliability) | other | foot pounds |
| isokinetic knee flexion using Cybex340 | 7.5% (reliability) | other | foot pounds |
| isokinetic trunk extension using the Lumex Trunk Extension Flexion Unit | 11.4% (reliability) | other | foot pounds |
| isokinetic trunk flexion using the Lumex Trunk Extension Flexion Unit | 3.5% (reliability) | other | foot pounds |
| calibrated digital scale (SECA, model 770), accurate to 0.1 kg | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| Lunar Model DPX-L | | kilograms | |
| Lunar Model DPX-L | | percentage | |
| Lunar Model DPX-L | 2.4% (precision) | gm_cm_2 | |
| Lunar Model DPX-L | 2.4% (precision) | gm_cm_2 | |
| Lunar Model DPX-L | 1.8% (precision) | gm_cm_2 | |
| Lunar Model DPX-L | 0.8% (precision) | gm_cm_2 | |
| calibrated digital scale (SECA, model 770), accurate to 0.1 kg | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| Lunar Model DPX-L | | kilograms | |
| Lunar Model DPX-L | | percentage | |
| Lunar Model DPX-L | 2.4% (precision) | gm_cm_2 | |
| Lunar Model DPX-L | 2.4% (precision) | gm_cm_2 | |
| Lunar Model DPX-L | 1.8% (precision) | gm_cm_2 | |
| Lunar Model DPX-L | 0.8% (precision) | gm_cm_2 | |
| Lunar DP3 | 3% (precision error) | gm_cm_2 | |
| | | kilograms | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| | | percentage | |
| | | kilograms | |
| | | mlkgmin | |
| | | milligrams | |
| Lunar DP3 | 3% (precision error) | gm_cm_2 | |
| | | kilograms | |
| | | percentage | |
| | | kilograms | |
| | | mlkgmin | |
| | | milligrams | |
| | 0.5-0.8% (coefficient of variatio | gm_cm_2 | |
| | 0.5-0.8% (coefficient of variatio | gm_cm_2 | |
| | 0.5-0.8% (coefficient of variatio | gm_cm_2 | |
| | 0.5-0.8% (coefficient of variatio | gm_cm_2 | |
| | 0.5-0.8% (coefficient of variatio | gm_cm_2 | |
| | 0.5-0.8% (coefficient of variatio | gm_cm_2 | |
| | 0.5-0.8% (coefficient of variatio | gm_cm_2 | |
| | 0.5-0.8% (coefficient of variatio | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| biceps, triceps, subscapularis, and suprailiac with a Harpenden skinfold caliper | | percentage | |
| | | kilograms | |
| estimated VO2 max from a 2 km walking test | | mlkgmin | |
| 3-day diet records | | milligrams | |
| trunk extension with an arm dynamometer (Digitest, Muurame, Finland) | | kilograms | |
| trunk flexion with an arm dynamometer (Digitest, Muurame, Finland) | | kilograms | |
| leg extension with a leg press dynamometer (Tamtron, Tampere, Finland) | | kilograms | |
| elbow flexion with an arm dynamometer (Digitest, Muurame, Finland) | | kilograms | |
| leg extensor power with vertical counter-movement jump test/no weight (Newtest, Oulu, Finland) | | other | meters/second |
| leg extensor power with vertical counter-movement jump test (10% more weight) (Newtest, Oulu, Finland) | | other | meters/second |
| figure 8 running test around 2 poles, 10 meters apart | | other | seconds |
| | 0.7-1.7% (coefficient of variatio | gm_cm_2 | |
| | 0.7-1.7% (coefficient of variatio | gm_cm_2 | |
| | 0.7-1.7% (coefficient of variatio | gm_cm_2 | |
| | 0.7-1.7% (coefficient of variatio | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| | | percentage | |
| | | kilograms | |
| | | milligrams | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| trunk extension with an arm dynamometer (Digitest, Muurame, Finland) | | kilograms | |
| trunk flexion with an arm dynamometer (Digitest, Muurame, Finland) | | kilograms | |
| leg extension with a leg press dynamometer (Tamtron, Tampere, Finland) | | kilograms | |
| elbow flexion with an arm dynamometer (Digitest, Muurame, Finland) | | kilograms | |
| maximum oxygen consumption using a bicylce ergometer test | | litersmin | |
| | 0.7-1.7% (coefficient of variatio | gm_cm_2 | |
| | 0.7-1.7% (coefficient of variatio | gm_cm_2 | |
| | 0.7-1.7% (coefficient of variatio | gm_cm_2 | |
| | 0.7-1.7% (coefficient of variatio | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| | | percentage | |
| | | milligrams | |
| trunk extension with an arm dynamometer (Digitest, Muurame, Finland) | | kilograms | |
| trunk flexion with an arm dynamometer (Digitest, Muurame, Finland) | | kilograms | |
| leg extension with a leg press dynamometer (Tamtron, Tampere, Finland) | | kilograms | |
| elbow flexion with an arm dynamometer (Digitest, Muurame, Finland) | | kilograms | |
| maximum oxygen consumption using a bicylce ergometer test | | litersmin | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| wearing light clothing and without shoes or socks | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| hangrip strength using a handgrip dynamometer (Takei Scientific Instruments) | | kilograms | |
| quadriceps device | | kilograms | |
| SMART Balance Master (NeuroCom) | | other | 1-100 |
| single stance (average of both legs) | | other | seconds |
| single stance (average of dominant leg) | | other | seconds |
| Hologic QDR-4500 | | kilograms | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| wearing light clothing and without shoes or socks | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| hangrip strength using a handgrip dynamometer (Takei Scientific Instruments) | | kilograms | |
| quadriceps device | | kilograms | |
| SMART Balance Master (NeuroCom) | | other | 1-100 |
| single stance (average of both legs) | | other | seconds |

Outcome Characteristics

| | | | |
|---|---|---|---|
| single stance (average of dominant leg) | | other | seconds |
| Hologic QDR-4500 | | kilograms | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| wearing light clothing and without shoes or socks | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| hangrip strength using a handgrip dynamometer (Takei Scientific Instruments) | | kilograms | |
| quadriceps device | | kilograms | |
| SMART Balance Master (NeuroCom) | | other | 1-100 |
| single stance (average of both legs) | | other | seconds |
| single stance (average of dominant leg) | | other | seconds |
| Hologic QDR-4500 | | kilograms | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| Hologic QDR-4500 | | gm_cm_2 | |
| wearing light clothing and without shoes or socks | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| hangrip strength using a handgrip dynamometer (Takei Scientific Instruments) | | kilograms | |
| quadriceps device | | kilograms | |
| SMART Balance Master (NeuroCom) | | other | 1-100 |
| single stance (average of both legs) | | other | seconds |
| single stance (average of dominant leg) | | other | seconds |
| Hologic QDR-4500 | | kilograms | |
| | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| Norland XR-26 | 1.14% (coefficient of variation) | gm_cm_2 | |
| Norland Excell | | gm_cm_2 | |
| Norland Excell | | gm_cm_2 | |
| AccuSway OR6-7 computerized force platform | | gm_cm_2 | |
| mean of 1RM for 8 upper and lower body exercises | | kilograms | |
| standard balance beam scale calibrated daily | | kilograms | |
| digital scale wearing mimimal clothing | | kilograms | |
| Hologic QDR 4500 | | percentage | |
| 4-day dietary protocols | | milligrams | |
| maximal treadmill test | | mlkgmin | |
| Hologic QDR 4500 | 0.9% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.0% (coefficient of variation) | gm_cm_2 | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| fall calendars completed by participants | | other | fall rate |
| | | kilograms | |
| | | gm_cm_2 | |
| | | percentage | |
| | | kilograms | |
| Hologic QDR 2000 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.5% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 3.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.6% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.4% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.3% (coefficient of variation) | gm_cm_2 | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| | | kilograms | |
| | | gm_cm_2 | |
| | | percentage | |
| | | kilograms | |
| Hologic QDR 2000 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.5% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 3.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.6% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.4% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.3% (coefficient of variation) | gm_cm_2 | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| 1RM maximum | | kilograms | |
| | | kilograms | |
| | | percentage | |
| | | kilograms | |
| Hologic QDR 4500 | 1.0% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | | gm_cm_2 | |
| Hologic QDR 4500 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.5% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.6% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.4% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.0% (coefficient of variation) | gm_cm_2 | |
| | | kilograms | |
| | | percentage | |
| | | kilograms | |
| Hologic QDR 4500 | 1.0% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | | gm_cm_2 | |
| Hologic QDR 4500 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.5% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.6% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.4% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500 | 1.3% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 2000 | 1.0% (coefficient of variation) | gm_cm_2 | |
| digital scale | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| 3-day food diary (two weekdays and one weekend day) | | milligrams | |
| 3-day food diary (two weekdays and one weekend day) | | other | micrograms |
| Lunar Prodigy | | gm_cm_2 | |
| Lunar Prodigy | | gm_cm_2 | |
| Lunar Prodigy | | gm_cm_2 | |
| digital scale | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| 3-day food diary (two weekdays and one weekend day) | | milligrams | |
| 3-day food diary (two weekdays and one weekend day) | | other | micrograms |
| Lunar Prodigy | | gm_cm_2 | |
| Lunar Prodigy | | gm_cm_2 | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| Lunar Prodigy | | gm_cm_2 | |
| without clothes in light clothing using a clinical scale (Detecto) | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| Balke-Ware treadmill protocol | | mlkgmin | |
| Lunar PIXI #50828 | 0.585% (coefficient of variatior | gm_cm_2 | |
| Lunar PIXI #50828 | 2.79% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | 0.339% (coefficient of variatior | gm_cm_2 | |
| Hologic QDR 4500W | | percentage | |
| Hologic QDR 4500W | | kilograms | |
| 3-day dietary intake record | | milligrams | |
| 1RM maximum | | kilograms | |
| without clothes in light clothing using a clinical scale (Detecto) | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| Balke-Ware treadmill protocol | | mlkgmin | |
| Lunar PIXI #50828 | 0.585% (coefficient of variatior | gm_cm_2 | |
| Lunar PIXI #50828 | 2.79% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | | gm_cm_2 | |
| Hologic QDR 4500W | 0.339% (coefficient of variatior | gm_cm_2 | |
| Hologic QDR 4500W | | percentage | |
| Hologic QDR 4500W | | kilograms | |
| 3-day dietary intake record | | milligrams | |
| 1RM maximum | | kilograms | |
| | | kilograms | |
| Hologic DXA 4500 | .30% (coefficient of variation) | kilograms | |
| Hologic DXA 4500 | 1.42% (coefficient of variation) | kilograms | |
| Hologic DXA 4500 | <1.2% (coefficient of variation) | gm_cm_2 | |
| Hologic DXA 4500 | <1.2% (coefficient of variation) | gm_cm_2 | |
| Hologic DXA 4500 | <1.2% (coefficient of variation) | gm_cm_2 | |
| Norland/Stratec XCT 540 densitometer | | other | mg/mm |
| Norland/Stratec XCT 540 densitometer | | other | mmsquared |
| Norland/Stratec XCT 540 densitometer | | other | mg/cmcubed |

Outcome Characteristics

| | | | |
|---|---|---|---|
| Norland/Stratec XCT 540 densitometer | | other | mmcubed |
| Norland/Stratec XCT 540 densitometer | | other | mg/mm |
| Norland/Stratec XCT 540 densitometer | | other | mmsquared |
| Norland/Stratec XCT 540 densitometer | | other | mg/cmcubed |
| Norland/Stratec XCT 540 densitometer | | other | mg/mm |
| Norland/Stratec XCT 540 densitometer | | other | mmsquared |
| Norland/Stratec XCT 540 densitometer | | other | mg/cmcubed |
| Norland/Stratec XCT 540 densitometer | | other | mmcubed |
| Norland/Stratec XCT 540 densitometer | | other | mg/mm |
| Norland/Stratec XCT 540 densitometer | | other | mmsquared |
| Norland/Stratec XCT 540 densitometer | | other | mg/cmcubed |
| | | kilograms | |
| Hologic DXA 4500 | .30% (coefficient of variation) | kilograms | |
| Hologic DXA 4500 | 1.42% (coefficient of variation) | kilograms | |
| Hologic DXA 4500 | <1.2% (coefficient of variation) | gm_cm_2 | |
| Hologic DXA 4500 | <1.2% (coefficient of variation) | gm_cm_2 | |
| Hologic DXA 4500 | <1.2% (coefficient of variation) | gm_cm_2 | |
| Norland/Stratec XCT 540 densitometer | | other | mg/mm |
| Norland/Stratec XCT 540 densitometer | | other | mmsquared |
| Norland/Stratec XCT 540 densitometer | | other | mg/cmcubed |
| Norland/Stratec XCT 540 densitometer | | other | mmcubed |
| Norland/Stratec XCT 540 densitometer | | other | mg/mm |
| Norland/Stratec XCT 540 densitometer | | other | mmsquared |
| Norland/Stratec XCT 540 densitometer | | other | mg/cmcubed |
| Norland/Stratec XCT 540 densitometer | | other | mg/mm |
| Norland/Stratec XCT 540 densitometer | | other | mmsquared |
| Norland/Stratec XCT 540 densitometer | | other | mg/cmcubed |
| Norland/Stratec XCT 540 densitometer | | other | mmcubed |
| Norland/Stratec XCT 540 densitometer | | other | mg/mm |
| Norland/Stratec XCT 540 densitometer | | other | mmsquared |
| Norland/Stratec XCT 540 densitometer | | other | mg/cmcubed |
| | 1-4 | gm_cm_2 | |
| | 1-4 | gm_cm_2 | |
| | 1-4 | gm_cm_2 | |
| | 1-4 | gm_cm_2 | |
| | 1-4 | gm_cm_2 | |
| | 1-4 | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| | | percentage | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| | | kilograms | |
| 4-day diet record (three weekdays and 1 weekend day) | | milligrams | |
| 4-day diet record (three weekdays and 1 weekend day) | | other | micrograms |
| derived from measures of height and weight | | kgmsquared | |
| Hologic QDR-4500A | 1.1% (coefficient of variation) | kilograms | |
| Hologic QDR-4500A | 3.1% (coefficient of variation) | percentage | |
| 8-foot up and go test | | other | seconds |
| one-leg stand | | other | seconds |
| knee extension 180 degrees/second using an isokinetic dynamometer (Biodex System 4 Pro) | | percentage | |
| knee flexion 180 degrees/second using an isokinetic dynamometer (Biodex System 4 Pro) | | percentage | |
| knee extension 60 degrees/second using an isokinetic dynamometer (Biodex System 4 Pro) | | percentage | |
| knee flexion 60 degrees/second using an isokinetic dynamometer (Biodex System 4 Pro) | | percentage | |
| Hologic QDR-4500A | 0.9% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR-4500A | | gm_cm_2 | |
| Hologic QDR-4500A | | gm_cm_2 | |
| Hologic QDR-4500A | 1.1% (coefficient of variation) | gm_cm_2 | |
| 4-day diet record (three weekdays and 1 weekend day) | | milligrams | |
| 4-day diet record (three weekdays and 1 weekend day) | | other | micrograms |
| derived from measures of height and weight | | kgmsquared | |
| Hologic QDR-4500A | 1.1% (coefficient of variation) | kilograms | |
| Hologic QDR-4500A | 3.1% (coefficient of variation) | percentage | |
| 8-foot up and go test | | other | seconds |
| one-leg stand | | other | seconds |
| knee extension 180 degrees/second using an isokinetic dynamometer (Biodex System 4 Pro) | | percentage | |
| knee flexion 180 degrees/second using an isokinetic dynamometer (Biodex System 4 Pro) | | percentage | |
| knee extension 60 degrees/second using an isokinetic dynamometer (Biodex System 4 Pro) | | percentage | |
| knee flexion 60 degrees/second using an isokinetic dynamometer (Biodex System 4 Pro) | | percentage | |
| Hologic QDR-4500A | 0.9% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR-4500A | | gm_cm_2 | |
| Hologic QDR-4500A | | gm_cm_2 | |
| Hologic QDR-4500A | 1.1% (coefficient of variation) | gm_cm_2 | |
| 4-day diet record (three weekdays and 1 weekend day) | | milligrams | |
| 4-day diet record (three weekdays and 1 weekend day) | | other | micrograms |
| derived from measures of height and weight | | kgmsquared | |
| Hologic QDR 4500A | 3.6% (coefficient of variation) | percentage | |
| Hologic QDR 4500A | 1.1% (coefficient of variation) | kilograms | |
| 6-minute walk test | | meters | |
| handgrip strength with digital dynamometer (Grip-D, Model TKK 5401) | | kilograms | |
| 8-foot up and go test | | other | seconds |
| one-leg stand | | other | seconds |

Outcome Characteristics

| | | | |
|---|---|---|---|
| chair stand test | | other | repetitions |
| isokinetic right knee extension (180 degrees/second) | | other | peak torque/boc |
| isokinetic left knee extension (180 degrees/second) | | other | peak torque/boc |
| isokinetic right knee flexion (180 degrees/second) | | other | peak torque/boc |
| isokinetic left knee flexion (180 degrees/second) | | other | peak torque/boc |
| isokinetic right knee extension (60 degrees/second) | | other | peak torque/boc |
| isokinetic left knee extension (60 degrees/second) | | other | peak torque/boc |
| isokinetic right knee flexion (60 degrees/second) | | other | peak torque/boc |
| isokinetic left knee flexion (60 degrees/second) | | other | peak torque/boc |
| Hologic QDR 4500A | 0.9% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | | gm_cm_2 | |
| Hologic QDR 4500A | 1.1% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 4500A | 0.8% (coefficient of variation) | gm_cm_2 | |
| | 2 | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| | | mlkgmin | |
| | 2 | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| | | mlkgmin | |
| | 2.1 | gm_cm_2 | |
| | 1 | gm_cm_2 | |
| | | kilograms | |
| | | kgmsquared | |
| | | milligrams | |
| 1 RM | | kilograms | |
| 1 RM | .88 (reliability) | kilograms | |
| 1 RM | | kilograms | |
| 1 RM | | kilograms | |
| 1 RM | | kilograms | |
| tandem walk test over a 20 foot course | | other | seconds |
| Harvard Alumni Questionnaire | | other | kj/wk |
| | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| Hologic QDR 1500 | | gm_cm_2 | |
| Hologic QDR 1500 | 0.87% (coefficient of variation) | gm_cm_2 | |
| Hologic QDR 1500 | 1.0% (coefficient of variation) | gm_cm_2 | |
| | 1 | mg_cm_2 | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| | 1.5 | mg_cm_2 | |
| | 1.8 | mg_cm_2 | |
| | 2.2 | mg_cm_2 | |
| | 2.2 | mg_cm_2 | |
| | 2.3 | mg_cm_2 | |
| | 1.8 | mg_cm_2 | |
| | 1.8 | mg_cm_2 | |
| | | kilograms | |
| Lunar DPX | ~1.0% (coefficient of variation) | gm_cm_2 | |
| Lunar DPX | ~1.0% (coefficient of variation) | gm_cm_2 | |
| Lunar DPX | ~1.0% (coefficient of variation) | gm_cm_2 | |
| Lunar DPX | ~1.0% (coefficient of variation) | gm_cm_2 | |
| hand dynamometer | | kilograms | |
| 1 RM | | kilograms | |
| 1 RM | | kilograms | |
| 1 RM | | kilograms | |
| 1 RM | | kilograms | |
| 1 RM | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| graded treadmill walking | | mlkgmin | |
| | | kilograms | |
| Hologic Delphi 4500/w | | kilograms | |
| Hologic Delphi 4500/w | | kilograms | |
| Hologic Delphi 4500/w | | gm_cm_2 | |
| 1RM (sum of biceps curl, bench press, seated row, knee extension, knee flexion, leg press) | | pounds | |
| time needed to complete and obstacle course | | | seconds |
| one-leg stand | | | seconds |
| Hologic Delphi 4500/w | | gm_cm_2 | |
| Hologic Delphi 4500/w | | gm_cm_2 | |
| body weight | | kilograms | |
| maximum oxygen consumption test | | mlkgmin | |
| Hologic QDR-1000/W | | gm_cm_2 | |
| Hologic QDR-1000/W | | gm_cm_2 | |
| Hologic QDR-1000/W | | gm_cm_2 | |
| Hologic QDR-1000/W | | gm_cm_2 | |
| Hologic QDR-1000/W | | gm_cm_2 | |
| | | milligrams | |
| | | IU | |
| 1 RM | | pounds | |
| 1 RM | | pounds | |

Outcome Characteristics

| | | | |
|---|---|---|---|
| digital stand-on scale (Scale-tronix 5005) | | kilograms | |
| DXA (Lunar Prodigy) | <1.0% (coefficient of variation) | kilograms | |
| DXA (Lunar Prodigy) | <1.0% (coefficient of variation) | kilograms | |
| DXA (Lunar Prodigy) | <1.0% (coefficient of variation) | gm_cm_2 | |
| DXA (Lunar Prodigy) | <1.0% (coefficient of variation) | gm_cm_2 | |
| DXA (Lunar Prodigy) | <1.0% (coefficient of variation) | gm_cm_2 | |
| DXA (Lunar Prodigy) | <0.8% (coefficient of variation) | gm_cm_2 | |
| VO2 max (ml/kg/min) on motorized treadmill | | mlkgmin | |
| addiitonal pounds lifted | | pounds | |
| Lunar DXA, version 1.2 | | kilograms | |
| Lunar DXA | 1% (short term precison); 1.2% | gm_cm_2 | |
| Lunar SP2 | 1% (short term precison); 1.5% | gm_cm_2 | |
| Lunar DXA | 1% (short term precison); 2.3% | gm_cm_2 | |
| Lunar DXA | 2% (short term precison); 2.5% | gm_cm_2 | |
| Lunar DXA | 2% (short term precison); 3.3% | gm_cm_2 | |
| light clothing on a calibrated electronic scale | | kilograms | |
| food frequency questionnaire | | milligrams | |
| | | kilograms | |
| DPX (Lunar) | 2.3% (coefficient of variation) | gm_cm_2 | |
| DPX (Lunar) | 5.0% (coefficient of variation) | gm_cm_2 | |
| | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| 3 day diet records | | milligrams | |
| 3 day diet records | | | micrograms |
| Hologic QDR-4500A | 0.8% (short-term precision) | gm_cm_2 | |
| Hologic QDR-4500A | | kilograms | |
| Hologic QDR-4500A | | kilograms | |
| Hologic QDR-4500A | 0.5% (short-term precision); 0.3 | gm_cm_2 | |
| Hologic QDR-4500A | 1.5% (short-term precision) | gm_cm_2 | |
| Hologic QDR-4500A | | gm_cm_2 | |
| Hologic QDR-4500A | | gm_cm_2 | |
| | | kilograms | |
| derived from measures of height and weight | | kgmsquared | |
| Lunar Prodigy | | gm_cm_2 | |
| Lunar Prodigy | | gm_cm_2 | |
| Lunar Prodigy | | gm_cm_2 | |

Outcome Characteristics

| analysis_type | n_e | i_e | i_se_e | i_sd_e | f_e | f_se_e | f_sd_e | d_e | d_sd_e | d_se_e | lci_e | uci_e | p_e | p_sd_e | p_se_e | p_lci_e | p_uci_e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 16 | | | | | | | | | | | | 0.20 | 1.88 | | -0.80 | 1.20 |
| abp | 16 | | | | | | | | | | | | -0.50 | 3.10 | | -2.20 | 1.10 |
| abp | 16 | | | | | | | | | | | | 0.80 | 2.16 | | -0.40 | 1.90 |
| abp | 16 | | | | | | | | | | | | 0.90 | 3.10 | | -0.80 | 2.50 |
| abp | 16 | 58.10 | | 7.90 | 57.6 | | | -0.50 | 3.0964843 | | -2.2 | 1.1 | -0.86 | | | | |
| abp | 16 | 21.70 | | 3.00 | | | | | | | | | | | | | |
| abp | 16 | 26.10 | | 6.50 | | | | | | | | | | | | | |
| abp | 13 | | | | | | | | | | | | 0.90 | 1.82 | | -0.20 | 2.00 |
| abp | 13 | | | | | | | | | | | | 1.50 | 2.98 | | -0.30 | 3.30 |
| abp | 13 | | | | | | | | | | | | 0.50 | 1.99 | | -0.70 | 1.70 |
| abp | 13 | | | | | | | | | | | | 0.10 | 2.90 | | -1.60 | 1.90 |
| abp | 13 | 60.30 | | 10.30 | 59.9 | | | -0.40 | 3.8060947 | | -2.7 | 1.9 | -0.66 | | | | |
| abp | 13 | 22.40 | | 3.30 | | | | | | | | | | | | | |
| abp | 13 | 27.80 | | 6.20 | | | | | | | | | | | | | |
| abp | 16 | | | | | | | | | | | | 1.70 | 1.88 | | 0.70 | 2.70 |
| abp | 16 | | | | | | | | | | | | 2.20 | 3.00 | | 0.60 | 3.80 |
| abp | 16 | | | | | | | | | | | | 1.30 | 2.06 | | 0.20 | 2.40 |
| abp | 16 | | | | | | | | | | | | -0.80 | 3.00 | | -2.40 | 0.80 |
| abp | 16 | 60.70 | | 10.20 | 60.3 | | | -0.40 | 3.28415 | | -2.1 | 1.4 | -0.66 | | | | |
| abp | 16 | 22.90 | | 3.20 | | | | | | | | | | | | | |
| abp | 16 | 30.10 | | 6.10 | | | | | | | | | | | | | |
| abp | 30 | 1.14 | | 0.12 | 1.15 | | 0.12 | 0.01 | 0.016 | | | | 1.05 | | | | |
| abp | 30 | 0.97 | | 0.13 | 0.99 | | 0.13 | 0.02 | 0.027 | | | | 2.06 | | | | |
| abp | 30 | 0.82 | | 0.11 | 0.85 | | 0.11 | 0.02 | 0.033 | | | | 2.92 | | | | |
| abp | 30 | 60.7 | | 7.90 | 60.7 | | 7.90 | 0.00 | 3.5329874 | | | | 0.00 | | | | |
| abp | 30 | 22.7 | | 2.50 | 22.7 | | 2.50 | 0.00 | 1.118034 | | | | 0.00 | | | | |
| abp | 30 | 186.00 | | 45.00 | | | | 12.90 | 21.908902 | 4 | | | 6.94 | | | | |
| abp | 30 | 39.00 | | 8.00 | | | | 3.70 | 3.8340579 | 0.7 | | | 9.49 | | | | |
| abp | 45 | 1.09 | | 0.09 | 1.09 | | 0.09 | 0.00 | 0.027 | | | | -0.18 | | | | |
| abp | 45 | 0.89 | | 0.09 | 0.88 | | 0.09 | -0.02 | 0.033 | | | | -1.68 | | | | |
| abp | 45 | 0.77 | | 0.08 | 0.76 | | 0.08 | -0.01 | 0.02 | | | | -1.18 | | | | |
| abp | 45 | 64.7 | | 7.30 | 64.7 | | 7.30 | 0.00 | 3.2646592 | | | | 0.00 | | | | |
| abp | 45 | 25 | | 2.60 | 25 | | 2.60 | 0.00 | 1.1627553 | | | | 0.00 | | | | |
| abp | 45 | 1053 | | 246.00 | 1053 | | 246.00 | 0.00 | 110.01454 | | | | 0.00 | | | | |
| abp | 24 | 1.15 | | 0.12 | 1.17 | | 0.12 | 0.01 | 0.03 | | | | 1.22 | | | | |
| abp | 24 | 0.93 | | 0.12 | 0.93 | | 0.11 | 0.00 | 0.03 | | | | 0.11 | | | | |
| abp | 24 | 0.81 | | 0.13 | 0.81 | | 0.13 | 0.00 | 0.024 | | | | -0.01 | | | | |
| abp | 24 | 64.2 | | 5.30 | 64.2 | | 5.30 | 0.00 | 2.3702321 | | | | 0.00 | | | | |
| abp | 24 | 24.3 | | 2.00 | 24.3 | | 2.00 | 0.00 | 0.8944272 | | | | 0.00 | | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 24 | 1005 | | 324.00 | 1005 | | 324.00 | 0.00 | 144.8972 | | | | 0.00 | | | | |
| abp | 24 | 40.00 | | 7.00 | | | | 9.80 | 5.8787754 | 1.2 | | | 24.50 | | | | |
| abp | 48 | 24.40 | | 2.60 | | | | | | | | | | | | | |
| abp | 48 | 18.70 | | 4.50 | 14.1 | | 3.50 | -4.60 | 2.0371549 | | | | -24.60 | | | | |
| abp | 48 | 0.96 | | 0.08 | 0.957 | | 0.08 | 0.00 | 0.0344354 | | | | -0.31 | | | | |
| abp | 48 | 0.98 | | 0.08 | 0.983 | | 0.08 | 0.00 | 0.0367723 | | | | -0.10 | | | | |
| abp | 48 | 0.87 | | 0.07 | 0.878 | | 0.07 | 0.01 | 0.0322583 | | | | 0.57 | | | | |
| abp | 48 | 0.83 | | 0.08 | 0.829 | | 0.08 | 0.00 | 0.0348827 | | | | 0.00 | | | | |
| itt | 59 | 18.70 | | 4.50 | 14.1 | | 3.50 | -4.60 | 2.0371549 | | | | -24.60 | | | | |
| itt | 59 | 0.96 | | 0.08 | 0.958 | | 0.08 | 0.00 | 0.0355668 | | | | -0.42 | | | | |
| itt | 59 | 0.99 | | 0.08 | 0.984 | | 0.09 | 0.00 | 0.0374566 | | | | -0.30 | | | | |
| itt | 59 | 0.88 | | 0.07 | 0.878 | | 0.07 | 0.00 | 0.0307734 | | | | 0.23 | | | | |
| itt | 59 | 0.83 | | 0.07 | 0.828 | | 0.07 | 0.00 | 0.0321994 | | | | -0.24 | | | | |
| abp | 12 | 24.05 | | 2.44 | | | | | | | | | | | | | |
| abp | 12 | 1.27 | | 0.14 | 1.263 | | | -0.01 | 0.034641 | 0.01 | | | -0.55 | | | | |
| abp | 12 | 1.02 | | 0.10 | 1.01 | | 0.10 | -0.01 | 0.0442154 | | | | -1.27 | | | | |
| abp | 12 | | | | | | | | | | | | | | | | |
| abp | 15 | 0.71 | 0.00 | 0.00 | 0.704 | 0.001 | 0.00 | 0.00 | 0.0017321 | | | | -0.09 | 0.19 | 0.05 | | |
| abp | 15 | 0.88 | 0.00 | 0.00 | 0.88 | 0.001 | 0.00 | 0.00 | 0.0017321 | | | | -0.13 | 0.35 | 0.09 | | |
| abp | 15 | 38.00 | 9.00 | 34.86 | 62 | 5 | 19.36 | 24.00 | 19.364917 | | | | 63.16 | | | | |
| abp | 15 | 20.00 | 7.00 | 27.11 | 37 | 6 | 23.24 | 17.00 | 11.874342 | | | | 85.00 | | | | |
| abp | 15 | 68.00 | 23.24 | 90.01 | 63 | 11.62 | 45.00 | -5.00 | 53.24953 | | | | -7.35 | | | | |
| abp | 15 | 28.00 | 15.49 | 59.99 | 25 | 19.36 | 74.98 | -3.00 | 33.530772 | | | | -10.71 | | | | |
| abp | 15 | 31.00 | 19.36 | 74.98 | 27 | 15.49 | 59.99 | -4.00 | 33.530772 | | | | -12.90 | | | | |
| abp | 9 | 56.70 | | 5.80 | 56.3 | | 4.50 | -0.40 | 2.6286879 | | | | -0.71 | | | | |
| abp | 9 | 18.30 | | 3.20 | 17.1 | | 2.90 | -1.20 | 1.394991 | | | | -6.56 | | | | |
| abp | 9 | 21.67 | | 2.67 | 26.622 | | 2.23 | 4.96 | 1.64325 | | | | 22.87 | | | | |
| abp | 9 | 562.56 | | 98.35 | 671.67 | | 72.68 | 109.11 | 42.51601 | | | | 19.40 | | | | |
| abp | 9 | 7.33 | | 0.75 | 9.389 | | 0.96 | 2.06 | 0.52705 | | | | 28.03 | | | | |
| abp | 9 | 46.67 | | 5.55 | 65.222 | | 8.92 | 18.56 | 5.19281 | | | | 39.76 | | | | |
| abp | 9 | 112.00 | | 18.41 | 149.78 | | 23.40 | 37.78 | 11.18903 | | | | 33.73 | | | | |
| abp | 9 | 0.85 | | 0.09 | 0.84667 | | 0.09 | 0.00 | 0.01379 | | | | 0.11 | | | | |
| abp | 9 | 0.68 | | 0.08 | 0.68978 | | 0.07 | 0.01 | 0.02319 | | | | 1.26 | | | | |
| abp | 9 | 0.61 | | 0.09 | 0.61 | | 0.09 | 0.00 | 0.0192 | | | | 0.05 | | | | |
| abp | 9 | 0.56 | | 0.15 | 0.57911 | | 0.15 | 0.02 | 0.04577 | | | | 3.60 | | | | |
| abp | 9 | 0.93 | | 0.10 | 0.93922 | | 0.11 | 0.01 | 0.03329 | | | | 0.77 | | | | |
| abp | 10 | 60.60 | | 8.80 | 59.4 | | 7.60 | -1.20 | 3.8491558 | | | | -1.98 | | | | |
| abp | 10 | 21.10 | | 5.70 | 20.2 | | 4.70 | -0.90 | 2.5215075 | | | | -4.27 | | | | |
| abp | 10 | 22.10 | | 2.31 | 26.233 | | 2.33 | 4.13 | 2.824 | | | | 18.70 | | | | |
| abp | 10 | 573.22 | | 66.52 | 666.89 | | 75.26 | 93.67 | 50.69517 | | | | 16.34 | | | | |

## Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 10 | 6.83 | | 1.30 | 8.556 | | 1.16 | 1.72 | 0.66667 | | | | 25.20 | | | | |
| abp | 10 | 41.40 | | 7.83 | 60.111 | | 9.47 | 18.71 | 6.37974 | | | | 45.20 | | | | |
| abp | 10 | 124.11 | | 23.20 | 146.67 | | 22.28 | 22.56 | 12.52109 | | | | 18.17 | | | | |
| abp | 10 | 0.82 | | 0.08 | 0.8139 | | 0.08 | -0.01 | 0.01648 | | | | -1.13 | | | | |
| abp | 10 | 0.65 | | 0.03 | 0.6456 | | 0.03 | -0.01 | 0.01722 | | | | -0.77 | | | | |
| abp | 10 | 0.53 | | 0.04 | 0.531 | | 0.05 | 0.01 | 0.0152 | | | | 1.10 | | | | |
| abp | 10 | 0.44 | | 0.04 | 0.4411 | | 0.04 | 0.00 | 0.02164 | | | | 0.11 | | | | |
| abp | 10 | 0.91 | | 0.06 | 0.9218 | | 0.06 | 0.01 | 0.02359 | | | | 1.40 | | | | |
| abp | 38 | 1.04 | | 0.18 | 1.05 | | | 0.01 | 0.02 | | | | 0.57 | | | | |
| abp | 38 | 0.84 | | 0.11 | 0.86 | | | 0.02 | 0.04 | | | | 1.90 | | | | |
| abp | 38 | 0.50 | | 0.09 | 0.50 | | | 0.00 | 0.02 | | | | 0.20 | | | | |
| abp | 38 | 67.7 | | 10.90 | 67.6 | | | -0.10 | | | | | -0.15 | | | | |
| abp | 38 | 25.8 | | 3.80 | 25.79 | | | -0.01 | | | | | -0.04 | | | | |
| abp | 38 | 836 | | 216.00 | 864 | | 222.00 | 28.00 | 98.114219 | | | | 3.35 | | | | |
| abp | 10 | 72.00 | 4.30 | 13.60 | | | | | | | | | | | | | |
| abp | 10 | 27.00 | 1.70 | 5.38 | | | | | | | | | | | | | |
| abp | 10 | 44.00 | 2.00 | 6.32 | | | | | | | | | | | | | |
| abp | 10 | 1214.00 | 200.00 | 632.46 | | | | | | | | | | | | | |
| abp | 10 | 10.00 | 2.10 | 6.64 | | | | | | | | | | | | | |
| abp | 10 | 0.89 | 0.04 | 0.13 | 0.885 | 0.037 | 0.12 | -0.01 | 0.0565155 | | | | -0.60 | 3.16 | 1.00 | | |
| abp | 10 | 0.90 | 0.03 | 0.09 | 0.901 | 0.03 | 0.09 | 0.00 | 0.0424264 | | | | -0.20 | 2.21 | 0.70 | | |
| abp | 10 | 0.75 | 0.03 | 0.09 | 0.743 | 0.027 | 0.09 | 0.00 | 0.0400749 | | | | -0.10 | 2.85 | 0.90 | | |
| abp | 10 | 0.68 | 0.03 | 0.09 | 0.676 | 0.028 | 0.09 | 0.00 | 0.0404228 | | | | 0.20 | 3.48 | 1.10 | | |
| abp | 10 | 0.61 | 0.04 | 0.12 | 0.601 | 0.034 | 0.11 | -0.01 | 0.051049 | | | | -0.90 | 3.79 | 1.20 | | |
| abp | 10 | 0.97 | 0.03 | 0.10 | 0.974 | 0.031 | 0.10 | 0.00 | 0.0438406 | | | | 0.10 | 1.26 | 0.40 | | |
| abp | 10 | 22.50 | 3.10 | 9.80 | 39.3 | 5 | 15.81 | 16.80 | 8.191459 | | | | 90.00 | 66.41 | 21.00 | | |
| abp | 10 | 103.70 | 10.40 | 32.89 | 136.3 | 11.9 | 37.63 | 32.60 | 16.432285 | | | | 33.00 | 15.81 | 5.00 | | |
| abp | 18 | 75.40 | | 12.10 | 74.6 | | 12.90 | -0.80 | 5.6442891 | | | | -1.06 | | | | |
| abp | 18 | 29.10 | | 3.90 | 28.8 | | 4.30 | -0.30 | 1.8745666 | | | | -1.03 | | | | |
| abp | 18 | 31.70 | | 8.10 | 30.7 | | 9.20 | -1.00 | 4.0142247 | | | | -3.15 | | | | |
| abp | 18 | 40.80 | | 5.00 | 41.3 | | 4.80 | 0.50 | 2.2 | | | | 1.23 | | | | |
| abp | 18 | 43.30 | | 5.10 | 41.9 | | 5.90 | -1.40 | 2.5803101 | | | | -3.23 | | | | |
| abp | 18 | 1.13 | | 0.10 | 1.13 | | 0.11 | 0.00 | 0.0479583 | | | | 0.00 | | | | |
| abp | 18 | 1.16 | | 0.18 | 1.15 | | 0.18 | -0.01 | 0.0804984 | | | | -0.86 | | | | |
| abp | 18 | 0.94 | | 0.13 | 0.94 | | 0.13 | 0.00 | 0.0581378 | | | | 0.00 | | | | |
| abp | 18 | 0.87 | | 0.11 | 0.88 | | 0.11 | 0.01 | 0.0491935 | | | | 1.15 | | | | |
| abp | 18 | 0.78 | | 0.14 | 0.78 | | 0.13 | 0.00 | 0.0611555 | | | | 0.00 | | | | |
| abp | 18 | 0.73 | | 0.15 | 0.7 | | 0.10 | -0.03 | 0.074162 | | | | -4.11 | | | | |
| abp | 21 | 66.90 | | 8.70 | 67.1 | | 9.40 | 0.20 | 4.1043879 | | | | 0.30 | | | | |
| abp | 21 | 25.20 | | 2.70 | 25.5 | | 2.70 | 0.30 | 1.2074767 | | | | 1.19 | | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 21 | 38.60 | | 3.20 | 37.2 | | 3.70 | -1.40 | 1.6180235 | | | | -3.63 | | | | |
| abp | 21 | 0.97 | | 0.09 | 0.99 | | 0.09 | 0.02 | 0.0402492 | | | | 2.10 | | | | |
| abp | 21 | 0.67 | | 0.07 | 0.68 | | 0.07 | 0.01 | 0.031305 | | | | 1.50 | | | | |
| abp | 21 | 0.97 | | 0.18 | 1 | | 0.21 | 0.03 | 0.0919783 | | | | 3.10 | | | | |
| abp | 21 | 0.74 | | 0.06 | 0.74 | | 0.07 | 0.00 | 0.0306594 | | | | 0.00 | | | | |
| abp | 21 | 0.63 | | 0.07 | 0.67 | | 0.08 | 0.04 | 0.0349285 | | | | 6.30 | | | | |
| abp | 21 | 0.57 | | 0.10 | 0.6 | | 0.11 | 0.03 | 0.0479583 | | | | 5.30 | | | | |
| abp | 21 | 261.13 | | 41.57 | 280.57 | | 40.79 | 19.44 | 18.431941 | | | | 7.40 | | | | |
| abp | 21 | 240.08 | | 42.16 | 253.45 | | 46.44 | 13.37 | 20.245999 | | | | 5.60 | | | | |
| abp | 21 | 1.83 | | 0.28 | 2.11 | | 0.39 | 0.28 | 0.1842281 | | | | 15.30 | | | | |
| abp | 21 | 30.10 | | 25.87 | 52.9 | | 41.09 | 22.80 | 21.077193 | | | | 75.70 | | | | |
| abp | 21 | 55.14 | | 1.46 | 55.33 | | 1.56 | 0.19 | 0.6822903 | | | | 0.30 | | | | |
| abp | 32 | 70.14 | | 13.15 | | | | | | | | | | | | | |
| abp | 32 | 34.30 | | 6.10 | | | | | | | | | | | | | |
| abp | 32 | 1.08 | | 0.09 | | | | -1.08 | | | | | 1.30 | 2.80 | | | |
| abp | 32 | 0.88 | | 0.09 | | | | -0.88 | | | | | 0.50 | 2.60 | | | |
| abp | 32 | 0.72 | | 0.09 | | | | -0.72 | | | | | 2.60 | 6.10 | | | |
| abp | 32 | 34.70 | | 7.40 | | | | 2.30 | 5.2 | | | | 8.60 | 15.70 | | | |
| abp | 32 | 52.60 | | 16.90 | | | | 4.80 | 6.4 | | | | 16.70 | 25.40 | | | |
| abp | 32 | 37.70 | | 11.90 | | | | 4.60 | 4.7 | | | | 21.70 | 23.70 | | | |
| abp | 32 | 80.10 | | 30.50 | | | | 11.70 | 12.9 | | | | 26.60 | 31.60 | | | |
| abp | 32 | 93.20 | | 22.10 | | | | 3.80 | 11.9 | | | | 8.40 | 21.50 | | | |
| abp | 71 | 67.70 | | 12.40 | | | | | | | | | | | | | |
| abp | 71 | 25.30 | | 4.10 | | | | | | | | | | | | | |
| abp | 71 | 38.60 | | 4.50 | | | | | | | | | | | | | |
| abp | 71 | 37.90 | | 6.30 | | | | | | | | | | | | | |
| abp | 71 | 0.89 | | 0.13 | 0.902 | | | 0.01 | 0.029 | | | | 1.35 | | | | |
| abp | 71 | 0.75 | | 0.12 | 0.764 | | | 0.01 | 0.025 | | | | 1.87 | | | | |
| abp | 71 | 1.14 | | 0.15 | 1.149 | | | 0.01 | 0.022 | | | | 0.79 | | | | |
| abp | 71 | 1.12 | | 0.08 | 1.124 | | | 0.00 | 0.011 | | | | 0.36 | | | | |
| abp | 71 | 68.90 | | 11.40 | | | | | | | | | | | | | |
| abp | 71 | 25.80 | | 3.40 | | | | | | | | | | | | | |
| abp | 71 | 38.60 | | 4.60 | | | | | | | | | | | | | |
| abp | 71 | 39.30 | | 6.00 | | | | | | | | | | | | | |
| abp | 71 | 0.87 | | 0.13 | 0.875 | | | 0.01 | 0.036 | | | | 0.57 | | | | |
| abp | 71 | 0.74 | | 0.11 | 0.748 | | | 0.01 | 0.024 | | | | 1.08 | | | | |
| abp | 71 | 1.12 | | 0.18 | 1.12 | | | 0.00 | 0.029 | | | | 0.00 | | | | |
| abp | 71 | 1.11 | | 0.08 | 1.11 | | | 0.00 | 0.013 | | | | 0.00 | | | | |
| abp | 5 | 1.18 | | 0.10 | 1.18 | | 0.11 | 0.00 | 0.0479583 | | | | 0.00 | | | | |
| abp | 5 | 69 | | 12.67 | 69.1 | | 13.70 | 0.10 | 5.9813627 | | | | 0.14 | | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 5 | 38.3 | | 6.03 | 40.7 | | 6.69 | 2.40 | 2.9161173 | | | | 6.27 | | | | |
| abp | 5 | 42.57 | | | 40.98 | | | -1.60 | | | | | -3.75 | | | | |
| abp | 5 | 22.7 | | 2.06 | 21.7 | | 1.12 | -1.00 | 1.1597586 | | | | -4.41 | | | | |
| abp | 5 | 860.6 | | 512.70 | 860.6 | | 512.70 | 0.00 | 229.28641 | | | | 0.00 | | | | |
| abp | 5 | 1.17 | | 0.10 | 1.19 | | 0.10 | 0.02 | 0.0447214 | | | | 1.71 | | | | |
| abp | 5 | 72.3 | | 19.20 | 71.2 | | 20.20 | -1.10 | 8.8638592 | | | | -1.52 | | | | |
| abp | 5 | 41.3 | | 4.19 | 41.5 | | 4.32 | 0.20 | 1.9071078 | | | | 0.48 | | | | |
| abp | 5 | 42.44 | | | 41.65 | | | -0.79 | | | | | -1.86 | | | | |
| abp | 5 | 21.9 | | 2.93 | 23.6 | | 2.04 | 1.70 | 1.4098014 | | | | 7.76 | | | | |
| abp | 5 | 935 | | 326.70 | 935 | | 326.70 | 0.00 | 146.10468 | | | | 0.00 | | | | |
| abp | 39 | 1.03 | | 0.14 | | | | | | | | | | | | | |
| abp | 39 | 0.88 | | 0.10 | | | | | | | | | 1.60 | 2.51 | | | |
| abp | 39 | 0.94 | | 0.11 | | | | | | | | | | | | | |
| abp | 39 | 1.22 | | 0.11 | | | | | | | | | | | | | |
| abp | 39 | 1.04 | | 0.10 | | | | | | | | | | | | | |
| abp | 39 | 1.08 | | 0.10 | | | | | | | | | | | | | |
| abp | 39 | 0.61 | | 0.08 | | | | | | | | | | | | | |
| abp | 39 | 0.63 | | 0.07 | | | | | | | | | -1.50 | 3.77 | | | |
| abp | 39 | 62 | | 7.00 | 62 | | 7.00 | 0.00 | 3.1304952 | | | | 0.00 | | | | |
| abp | 39 | 23.2 | | 2.60 | 23.2 | | 2.60 | 0.00 | 1.1627553 | | | | 0.00 | | | | |
| abp | 39 | 30.9 | | 3.70 | 30.9 | | 3.70 | 0.00 | 1.6546903 | | | | 0.00 | | | | |
| abp | 39 | 42.84 | | | 42.84 | | | 0.00 | | | | | 0.00 | | | | |
| abp | 39 | 36.4 | | 3.10 | 39.5 | | | 3.10 | 3.61 | | | | 8.52 | | | | |
| abp | 39 | 1125 | | 240.00 | 1125 | | 240.00 | 0.00 | 107.33126 | | | | 0.00 | | | | |
| abp | 39 | 58.00 | | 7.30 | | | | | | | | | | | | | |
| abp | 39 | 40.50 | | 7.90 | | | | | | | | | | | | | |
| abp | 39 | 142.10 | | 22.40 | | | | | | | | | | | | | |
| abp | 39 | 21.00 | | 25.90 | | | | | | | | | | | | | |
| abp | 39 | 444.00 | | 38.00 | | | | | | | | | | | | | |
| abp | 39 | 410.00 | | 37.00 | | | | | | | | | | | | | |
| abp | 39 | 6.40 | | 0.50 | | | | | | | | | | | | | |
| abp | 26 | 1.00 | | 0.15 | | | | | | | | | | | | | |
| abp | 26 | 0.85 | | 0.11 | | | | | | | | | | | | | |
| abp | 26 | 0.64 | | 0.09 | | | | | | | | | | | | | |
| abp | 26 | 0.39 | | 0.05 | | | | | | | | | | | | | |
| abp | 26 | 68 | | 9.00 | | | | | | | | | | | | | |
| abp | 26 | 26.3 | | 3.60 | | | | | | | | | | | | | |
| abp | 26 | 31.5 | | 6.30 | | | | | | | | | | | | | |
| abp | 26 | 46.58 | | | | | | | | | | | | | | | |
| abp | 26 | 890 | | 276.00 | 890 | | 276.00 | 0.00 | 123.43095 | | | | 0.00 | | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 26 | 60.90 | | 11.30 | | | | | | | | | | | | | |
| abp | 26 | 45.00 | | 10.00 | | | | | | | | | | | | | |
| abp | 26 | 133.30 | | 23.60 | | | | | | | | | | | | | |
| abp | 26 | 19.30 | | 3.40 | | | | | | | | | | | | | |
| abp | 26 | 1.83 | | 0.27 | | | | | | | | | | | | | |
| abp | 23 | 1.00 | | 0.13 | | | | | | | | | | | | | |
| abp | 23 | 0.89 | | 0.10 | | | | | | | | | | | | | |
| abp | 23 | 0.63 | | 0.08 | | | | | | | | | | | | | |
| abp | 23 | 0.39 | | 0.05 | | | | | | | | | | | | | |
| abp | 23 | 71 | | 12.00 | | | | | | | | | | | | | |
| abp | 23 | 26.5 | | 4.00 | | | | | | | | | | | | | |
| abp | 23 | 33.3 | | 6.50 | | | | | | | | | | | | | |
| abp | 23 | 942 | | 243.00 | 942 | | 243.00 | 0.00 | 108.6729 | | | | 0.00 | | | | |
| abp | 23 | 58.00 | | 10.50 | | | | | | | | | | | | | |
| abp | 23 | 45.20 | | 8.40 | | | | | | | | | | | | | |
| abp | 23 | 137.80 | | 22.60 | | | | | | | | | | | | | |
| abp | 23 | 18.10 | | 3.70 | | | | | | | | | | | | | |
| abp | 23 | 1.89 | | 0.32 | | | | | | | | | | | | | |
| abp | | 0.86 | | 0.11 | | | | -0.86 | | | | | -0.42 | 2.50 | | | |
| abp | 30 | 0.69 | | 0.11 | | | | | | | | | | | | | |
| abp | 30 | 1.04 | | 0.13 | | | | | | | | | | | | | |
| abp | 30 | 0.95 | | 0.16 | | | | -0.95 | | | | | 1.31 | 2.30 | | | |
| abp | 30 | | | | | | | -0.79 | 1.81 | | | | | | | | |
| abp | 30 | 23.56 | | 3.44 | 23.4 | | 3.30 | -0.13 | 0.7 | | | | -0.55 | | | | |
| abp | 30 | | | | | | | 1.31 | 1.36 | | | | | | | | |
| abp | 30 | | | | | | | 1.55 | 4.49 | | | | | | | | |
| abp | 30 | | | | | | | 1.93 | 3.51 | | | | | | | | |
| abp | 30 | | | | | | | 29.70 | 45.1 | | | | | | | | |
| abp | 30 | | | | | | | 25.30 | 44.9 | | | | | | | | |
| abp | 30 | 44.20 | | 5.30 | 44.3 | | 5.30 | 0.10 | 2.3702321 | | | | 0.23 | | | | |
| abp | | 0.89 | | 0.09 | | | | -0.89 | | | | | -1.01 | 1.30 | | | |
| abp | 29 | 0.73 | | 0.08 | | | | | | | | | | | | | |
| abp | 29 | 1.06 | | 0.12 | | | | | | | | | | | | | |
| abp | 29 | 0.99 | | 0.16 | | | | -0.99 | | | | | 1.10 | 2.20 | | | |
| abp | 29 | | | | | | | -0.46 | 1.61 | | | | | | | | |
| abp | 29 | 24.10 | | 3.42 | 24 | | 3.50 | -0.08 | 0.59 | | | | -0.33 | | | | |
| abp | 29 | | | | | | | 1.00 | 1.27 | | | | | | | | |
| abp | 29 | | | | | | | 1.84 | 4.2 | | | | | | | | |
| abp | 29 | | | | | | | 3.28 | 4.71 | | | | | | | | |
| abp | 29 | | | | | | | 32.90 | 45 | | | | | | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 29 | | | | | | | 22.00 | 58.4 | | | | | | | | |
| abp | 29 | 45.80 | | 6.10 | 45.7 | | 6.10 | -0.10 | 2.7280029 | | | | -0.22 | | | | |
| abp | | 0.67 | | 0.09 | | | | -0.67 | | | | | 0.21 | 2.50 | | | |
| abp | 28 | 0.57 | | 0.07 | | | | | | | | | | | | | |
| abp | 28 | 0.83 | | 0.12 | | | | | | | | | | | | | |
| abp | 28 | 0.68 | | 0.09 | | | | -0.68 | | | | | 0.10 | 2.30 | | | |
| abp | 28 | | | | | | | 0.32 | 1.79 | | | | | | | | |
| abp | 28 | 24.40 | | 4.29 | 25.2 | | 4.40 | 0.64 | 0.77 | | | | 2.62 | | | | |
| abp | 28 | | | | | | | 0.89 | 1.36 | | | | | | | | |
| abp | 28 | | | | | | | 3.23 | 5.28 | | | | | | | | |
| abp | 28 | | | | | | | 1.89 | 4.05 | | | | | | | | |
| abp | 28 | | | | | | | 62.60 | 124.1 | | | | | | | | |
| abp | 28 | | | | | | | 3.57 | 26 | | | | | | | | |
| abp | 28 | 34.90 | | 5.40 | 35.3 | | 5.40 | 0.40 | 2.4149534 | | | | 1.15 | | | | |
| abp | | 0.68 | | 0.11 | | | | -0.68 | | | | | 0.00 | 4.50 | | | |
| abp | 30 | 0.57 | | 0.09 | | | | | | | | | | | | | |
| abp | 30 | 0.82 | | 0.14 | | | | | | | | | | | | | |
| abp | 30 | 0.69 | | 0.12 | | | | -0.69 | | | | | 2.00 | 2.60 | | | |
| abp | 30 | | | | | | | -0.09 | 1.73 | | | | | | | | |
| abp | 30 | 24.60 | | 4.00 | 24.8 | | 3.90 | 0.23 | 0.81 | | | | 0.93 | | | | |
| abp | 30 | | | | | | | 0.65 | 1.77 | | | | | | | | |
| abp | 30 | | | | | | | 0.84 | 4.66 | | | | | | | | |
| abp | 30 | | | | | | | 4.13 | 5.52 | | | | | | | | |
| abp | 30 | | | | | | | 49.50 | 198.1 | | | | | | | | |
| abp | 30 | | | | | | | 10.10 | 38.2 | | | | | | | | |
| abp | 30 | 35.30 | | 5.40 | 35.6 | | 5.40 | 0.30 | 2.4149534 | | | | 0.85 | | | | |
| abp | 8 | 45.50 | | 6.50 | | | | | | | | | | | | | |
| abp | 8 | 19.70 | | 1.30 | | | | | | | | | | | | | |
| abp | 8 | 0.60 | | 0.07 | 0.62 | | 0.09 | 0.03 | 0.0395702 | | | | 4.29 | 2.34 | | | |
| abp | 9 | 0.67 | | 0.04 | 0.74 | | 0.05 | 0.07 | 0.0223607 | | | | 10.45 | | | | |
| abp | 9 | 0.77 | | 0.07 | 0.88 | | 0.08 | 0.11 | 0.0349285 | | | | 14.29 | | | | |
| abp | 9 | 2.49 | | 0.52 | 1.83 | | 0.26 | -0.66 | 0.3076361 | | | | -26.51 | | | | |
| abp | 9 | 24.21 | | 3.84 | 29.58 | | 5.78 | 5.37 | 2.8640251 | | | | 22.18 | | | | |
| abp | 9 | 78.00 | | 9.20 | 73.8 | | 7.30 | -4.20 | 4.1281957 | | | | -5.38 | | | | |
| abp | 123 | 68.10 | | 10.90 | | | | | | | | | | | | | |
| abp | 123 | 36.30 | | 5.90 | | | | | | | | | | | | | |
| abp | 123 | 828.00 | | 414.00 | | | | | | | | | | | | | |
| abp | 123 | 24.10 | | 4.10 | | | | | | | | | | | | | |
| abp | 115 | 0.92 | | 0.16 | 0.936 | | 0.17 | 0.02 | 0.027 | | | | 1.77 | 2.76 | | 1.26 | 2.28 |
| abp | 115 | 0.71 | | | 0.713 | | | 0.01 | 0.024 | | | | 1.01 | 3.46 | | 0.37 | 1.65 |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 115 | 0.37 | | 0.68 | 1 | | 1.37 | 0.63 | 0.8138919 | | | | 170.27 | | | | |
| abp | 28 | 69.40 | | 11.40 | | | | | | | | | | | | | |
| abp | 28 | 0.98 | | 0.10 | | | | | | | | | | | | | |
| abp | 28 | 38.10 | | 7.70 | | | | | | | | | | | | | |
| abp | 28 | 41.50 | | | | | | | | | | | | | | | |
| abp | 23 | 0.65 | | 0.11 | | | | -0.65 | | | | | 1.70 | 4.10 | | | |
| abp | 23 | 0.98 | | 0.15 | | | | -0.98 | | | | | 1.50 | 3.00 | | | |
| abp | 23 | 0.72 | | 0.10 | | | | -0.72 | | | | | 0.00 | 3.10 | | | |
| abp | 23 | 0.55 | | 0.10 | | | | -0.55 | | | | | 2.30 | 4.00 | | | |
| abp | 25 | 0.36 | | 0.06 | | | | -0.36 | | | | | 2.40 | 4.30 | | | |
| abp | 25 | 0.50 | | 0.07 | | | | -0.50 | | | | | 0.50 | 3.20 | | | |
| abp | 25 | 0.56 | | 0.08 | | | | -0.56 | | | | | 0.90 | 3.50 | | | |
| abp | 23 | 54.00 | | 14.00 | 99 | | 22.00 | 45.00 | 11.207141 | | | | 94.00 | 83.00 | | | |
| abp | 23 | 45.00 | | 13.00 | 86 | | 26.00 | 41.00 | 15.381807 | | | | 106.00 | 97.00 | | | |
| abp | 23 | 42.00 | | 13.00 | 85 | | 27.00 | 43.00 | 16.315637 | | | | 114.00 | 90.00 | | | |
| abp | 23 | 49.00 | | 14.00 | 84 | | 17.00 | 35.00 | 7.5232971 | | | | 86.00 | 89.00 | | | |
| abp | 23 | 41.00 | | 13.00 | 73 | | 26.00 | 32.00 | 15.381807 | | | | 95.00 | 106.00 | | | |
| abp | 25 | 10.00 | | 2.00 | 13 | | 2.00 | 3.00 | 0.8944272 | | | | 38.00 | 40.00 | | | |
| abp | 25 | 6.00 | | 1.00 | 8 | | 2.00 | 2.00 | 1.183216 | | | | 49.00 | 42.00 | | | |
| abp | 25 | 9.00 | | 2.00 | 12 | | 2.00 | 3.00 | 0.8944272 | | | | 33.00 | 26.00 | | | |
| abp | 25 | 6.00 | | 1.00 | 10 | | 2.00 | 4.00 | 1.183216 | | | | 67.00 | 43.00 | | | |
| abp | 25 | 15.00 | | 3.00 | 26 | | 6.00 | 11.00 | 3.5496479 | | | | 71.00 | 26.00 | | | |
| abp | 28 | 70.80 | | 10.00 | | | | | | | | | | | | | |
| abp | 28 | 1.00 | | 0.12 | | | | | | | | | | | | | |
| abp | 28 | 40.40 | | 7.10 | | | | | | | | | | | | | |
| abp | 28 | 40.50 | | 4.00 | | | | | | | | | | | | | |
| abp | 19 | 0.65 | | 0.10 | | | | -0.65 | | | | | 0.30 | 2.80 | | | |
| abp | 19 | 1.02 | | 0.15 | | | | -1.02 | | | | | 0.30 | 2.40 | | | |
| abp | 19 | 0.75 | | 0.12 | | | | -0.75 | | | | | 0.20 | 4.20 | | | |
| abp | 19 | 0.58 | | 0.16 | | | | -0.58 | | | | | 1.90 | 8.90 | | | |
| abp | 21 | 0.37 | | 0.06 | | | | -0.37 | | | | | -0.20 | 5.90 | | | |
| abp | 21 | 0.53 | | 0.07 | | | | -0.53 | | | | | 0.10 | 1.40 | | | |
| abp | 21 | 0.60 | | 0.08 | | | | -0.60 | | | | | 0.40 | 2.80 | | | |
| abp | 19 | 51.00 | | 12.00 | 98 | | 18.00 | 47.00 | 8.8994382 | | | | 102.00 | 57.00 | | | |
| abp | 19 | 43.00 | | 9.00 | 87 | | 18.00 | 44.00 | 10.648944 | | | | 110.00 | 49.00 | | | |
| abp | 19 | 42.00 | | 13.00 | 82 | | 22.00 | 40.00 | 11.75585 | | | | 128.00 | 139.00 | | | |
| abp | 19 | 45.00 | | 8.00 | 86 | | 18.00 | 41.00 | 11.349009 | | | | 96.00 | 46.00 | | | |
| abp | 19 | 46.00 | | 15.00 | 69 | | 20.00 | 23.00 | 9.2195445 | | | | 50.00 | 44.00 | | | |
| abp | 21 | 10.00 | | 2.00 | 12 | | 2.00 | 2.00 | 0.8944272 | | | | 21.00 | 20.00 | | | |
| abp | 21 | 6.00 | | 1.00 | 8 | | 2.00 | 2.00 | 1.183216 | | | | 38.00 | 42.00 | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 21 | 9.00 | | 2.00 | 11 | | 3.00 | 2.00 | 1.4832397 | | | | 25.00 | 22.00 | | | |
| abp | 21 | 6.00 | | 2.00 | 9 | | 2.00 | 3.00 | 0.8944272 | | | | 52.00 | 36.00 | | | |
| abp | 21 | 15.00 | | 3.00 | 25 | | 6.00 | 10.00 | 3.5496479 | | | | 68.00 | 36.00 | | | |
| abp | 42 | 72.20 | | 12.00 | | | | | | | | | | | | | |
| abp | 42 | 43.00 | | 6.00 | | | | | | | | | | | | | |
| abp | 42 | 39.50 | | 4.20 | | | | | | | | | | | | | |
| abp | 24 | 0.90 | | 0.16 | | | | -0.90 | | | | | -0.65 | 2.12 | | | |
| abp | 24 | 0.86 | | 0.12 | | | | -0.86 | | | | | 0.57 | 1.76 | | | |
| abp | 24 | 0.67 | | 0.10 | | | | -0.67 | | | | | 0.00 | 2.33 | | | |
| abp | 24 | 1.01 | | 0.15 | | | | -1.01 | | | | | 0.70 | 2.08 | | | |
| abp | 24 | 0.72 | | 0.11 | | | | -0.72 | | | | | 1.04 | 2.81 | | | |
| abp | 24 | 0.36 | | 0.07 | | | | -0.36 | | | | | -0.71 | 2.77 | | | |
| abp | 24 | 0.53 | | 0.06 | | | | -0.53 | | | | | -0.35 | 2.25 | | | |
| abp | 24 | 0.62 | | 0.08 | | | | -0.62 | | | | | -0.07 | 2.65 | | | |
| abp | 24 | | | | | | | 0.00 | | | | | -0.62 | 1.38 | | | |
| abp | 42 | 69.00 | | 11.40 | | | | | | | | | | | | | |
| abp | 42 | 40.00 | | 7.00 | | | | | | | | | | | | | |
| abp | 42 | 39.60 | | 4.30 | | | | | | | | | | | | | |
| abp | 30 | 0.91 | | 0.12 | | | | -0.91 | | | | | -0.32 | 1.85 | | | |
| abp | 30 | 0.84 | | 0.11 | | | | -0.84 | | | | | -0.65 | 1.81 | | | |
| abp | 30 | 0.65 | | 0.09 | | | | -0.65 | | | | | -0.02 | 2.60 | | | |
| abp | 30 | 1.00 | | 0.15 | | | | -1.00 | | | | | -1.07 | 2.49 | | | |
| abp | 30 | 0.72 | | 0.09 | | | | -0.72 | | | | | 0.03 | 2.22 | | | |
| abp | 30 | 0.36 | | 0.07 | | | | -0.36 | | | | | -0.39 | 3.19 | | | |
| abp | 30 | 0.53 | | 0.07 | | | | -0.53 | | | | | -1.21 | 1.84 | | | |
| abp | 30 | 0.62 | | 0.06 | | | | -0.62 | | | | | -0.96 | 2.50 | | | |
| abp | 30 | | | | | | | 0.00 | | | | | -0.79 | 1.73 | | | |
| itt | 45 | 83.20 | | 11.90 | | | | | | | | | | | | | |
| itt | 45 | 27.40 | | 3.70 | | | | | | | | | | | | | |
| itt | 45 | 911.00 | | 360.00 | | | | | | | | | | | | | |
| itt | 45 | 1.20 | | 2.10 | | | | | | | | | | | | | |
| abp | 43 | 1.23 | | 0.16 | 1.236 | | 0.17 | 0.00 | 0.0741741 | | | | 0.93 | 2.82 | | | |
| abp | 43 | 0.92 | | 0.07 | 0.933 | | 0.07 | 0.01 | 0.0319906 | | | | 1.18 | 2.32 | | | |
| abp | 43 | 1.03 | | 0.08 | 1.03 | | 0.08 | 0.00 | 0.0367723 | | | | 0.37 | 2.21 | | | |
| itt | 46 | 85.20 | | 10.90 | | | | | | | | | | | | | |
| itt | 46 | 28.10 | | 3.30 | | | | | | | | | | | | | |
| itt | 46 | 1064.00 | | 449.00 | | | | | | | | | | | | | |
| itt | 46 | 0.80 | | 1.10 | | | | | | | | | | | | | |
| abp | 44 | 1.25 | | 0.14 | 1.26 | | 0.15 | 0.01 | 0.0645368 | | | | 1.01 | 2.66 | | | |
| abp | 44 | 0.94 | | 0.08 | 0.947 | | 0.08 | 0.01 | 0.0355668 | | | | 1.01 | 2.29 | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 44 | 1.02 | | 0.09 | 1.024 | | 0.09 | 0.00 | 0.0413787 | | | | 0.22 | 2.01 | | | |
| abp | 15 | 55.00 | | 9.20 | | | | | | | | | | | | | |
| abp | 15 | 22.00 | | 4.40 | | | | | | | | | | | | | |
| abp | 15 | 33.50 | | 4.80 | | | | | | | | | | | | | |
| abp | 15 | 0.53 | 0.01 | 0.04 | | | | | | | | | 0.80 | 3.79 | | -1.30 | 2.90 |
| abp | 15 | 0.45 | 0.01 | 0.04 | | | | | | | | | -0.50 | 4.60 | | -3.00 | 2.10 |
| abp | 15 | 1.10 | 0.02 | 0.08 | | | | | | | | | 0.40 | 2.08 | | -0.70 | 1.60 |
| abp | 15 | 0.92 | 0.02 | 0.08 | | | | | | | | | 0.50 | 2.62 | | -1.00 | 1.90 |
| abp | 15 | 0.85 | 0.03 | 0.12 | | | | | | | | | 0.50 | 3.25 | | -1.30 | 2.30 |
| abp | 15 | 0.69 | 0.02 | 0.08 | | | | | | | | | 0.50 | 4.33 | | -1.90 | 2.90 |
| abp | 15 | 0.84 | 0.03 | 0.12 | | | | | | | | | 1.10 | 5.42 | | -1.90 | 4.10 |
| abp | 15 | 0.99 | 0.02 | 0.08 | | | | | | | | | 0.90 | 2.17 | | -0.30 | 2.10 |
| abp | 15 | 30.00 | 1.40 | 5.42 | | | | | | | | | 1.00 | 10.56 | | -4.90 | 6.80 |
| abp | 15 | 39.20 | 1.20 | 4.65 | | | | | | | | | -0.20 | 4.15 | | -2.50 | 2.10 |
| abp | 15 | 877.00 | 123.00 | 476.38 | | | | | | | | | -0.50 | 360.25 | | -200.00 | 199.00 |
| abp | 15 | 80.00 | 5.70 | 22.08 | | | | | | | | | 55.00 | 28.44 | | 39.20 | 70.70 |
| abp | 16 | 54.70 | | 7.60 | | | | | | | | | | | | | |
| abp | 16 | 23.00 | | 4.20 | | | | | | | | | | | | | |
| abp | 16 | 33.10 | | 6.50 | | | | | | | | | | | | | |
| abp | 16 | 0.53 | 0.03 | 0.12 | | | | | | | | | 4.40 | 4.22 | | 2.10 | 6.60 |
| abp | 16 | 0.48 | 0.01 | 0.04 | | | | | | | | | 0.80 | 5.91 | | -2.40 | 3.90 |
| abp | 16 | 1.11 | 0.02 | 0.08 | | | | | | | | | 1.40 | 2.18 | | 0.18 | 2.50 |
| abp | 16 | 0.95 | 0.00 | | | | | | | | | | -1.00 | 2.53 | | -2.30 | 0.40 |
| abp | 16 | 0.86 | 0.03 | 0.12 | | | | | | | | | -0.70 | 5.16 | | -3.50 | 2.00 |
| abp | 16 | 0.71 | 0.03 | 0.12 | | | | | | | | | -0.30 | 2.91 | | -1.80 | 1.30 |
| abp | 16 | 0.83 | 0.05 | 0.20 | | | | | | | | | -2.00 | 5.63 | | -5.00 | 1.00 |
| abp | 16 | 1.01 | 0.03 | 0.12 | | | | | | | | | 1.30 | 2.44 | | -0.10 | 2.50 |
| abp | 16 | 31.00 | 1.50 | 6.00 | | | | | | | | | -2.40 | 11.26 | | -8.40 | 3.60 |
| abp | 16 | 38.70 | 1.10 | 4.40 | | | | | | | | | 0.50 | 3.57 | | -1.40 | 2.40 |
| abp | 16 | 764.00 | 119.00 | 476.00 | | | | | | | | | 16.30 | 443.83 | | -220.00 | 253.00 |
| abp | 16 | 89.00 | 5.80 | 23.20 | | | | | | | | | 14.00 | 29.46 | | -2.00 | 29.40 |
| abp | 32 | 59.90 | | 9.40 | 58.70 | | | -1.20 | 3.6 | | | | -2.00 | | | | |
| abp | 32 | 38.00 | | 4.10 | 38.4 | | | 0.40 | 1.1 | | | | 1.05 | | | | |
| abp | 32 | 20.60 | | 5.70 | 20.5 | | | -0.10 | 1.3 | | | | -0.49 | | | | |
| abp | 29 | 0.67 | | 0.14 | 0.671 | | | 0.00 | 0.0197171 | | -0.01 | 0.009 | 0.15 | | | | |
| abp | 29 | 0.58 | | 0.11 | 0.578 | | | 0.00 | 0.0184027 | | -0.01 | 0.005 | -0.34 | | | | |
| abp | 29 | 0.51 | | 0.11 | 0.52 | | | 0.01 | 0.0354909 | | -0 | 0.023 | 1.96 | | | | |
| abp | 32 | 214.11 | | 68.83 | 213.03 | | | -1.08 | 6.43482 | | -3.4 | 1.24 | -0.50 | | | | |
| abp | 32 | 198.21 | | 56.65 | 197.16 | | | -1.05 | 2.9261789 | | -3.4 | -1.29 | -0.53 | | | | |
| abp | 32 | 1069.04 | | 48.01 | 1068.98 | | | -0.06 | 15.074675 | | -5.49 | 5.38 | -0.01 | | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 32 | 1260.37 | | 348.00 | 1246.7 | | | -13.67 | 58.689996 | | -34.8 | 7.49 | -1.08 | | | | |
| abp | 31 | 160.11 | | 37.72 | 159.66 | | | -0.45 | 3.5305059 | | -1.75 | 0.84 | -0.28 | | | | |
| abp | 31 | 537.12 | | 79.69 | 538.72 | | | 1.60 | 17.925155 | | -4.98 | 8.17 | 0.30 | | | | |
| abp | 31 | 304.26 | | 81.84 | 302.02 | | | -2.24 | 12.431743 | | -6.8 | 2.32 | -0.74 | | | | |
| abp | 21 | 57.64 | | 18.59 | 58.64 | | | 1.00 | 3.6577767 | | -0.66 | 2.67 | 1.73 | | | | |
| abp | 21 | 51.78 | | 14.01 | 52.23 | | | 0.45 | 2.9767492 | | -0.91 | 1.8 | 0.87 | | | | |
| abp | 21 | 1096.80 | | 76.55 | 1112.19 | | | 15.39 | 28.811857 | | 2.27 | 28.5 | 1.40 | | | | |
| abp | 21 | | | | | | | 4.95 | 14.158781 | | -1.5 | 11.39 | | | | | |
| abp | 27 | 57.07 | | 17.87 | 58.06 | | | 0.99 | 9.1256832 | | -2.57 | 4.65 | 1.73 | | | | |
| abp | 27 | 120.22 | | 31.27 | 123.26 | | | 3.04 | 32.710898 | | -9.9 | 15.98 | 2.53 | | | | |
| abp | 27 | 478.02 | | 85.77 | 475.27 | | | -2.75 | 48.118388 | | -36.8 | 1.28 | -0.58 | | | | |
| abp | 34 | 62.50 | | 9.30 | 61.5 | | | -1.00 | 2.1 | | | | -1.60 | | | | |
| abp | 34 | 38.10 | | 4.50 | 38.4 | | | 0.30 | 1 | | | | 0.79 | | | | |
| abp | 34 | 23.90 | | 6.30 | 23.4 | | | -0.50 | 1.5 | | | | -2.09 | | | | |
| abp | 33 | 0.69 | | 0.11 | 0.70 | | | 0.01 | 0.0183313 | | 0 | 0.013 | 0.87 | | | | |
| abp | 33 | 0.60 | | 0.08 | 0.60 | | | 0.00 | 0.0197414 | | -0 | 0.011 | 0.67 | | | | |
| abp | 33 | 0.53 | | 0.08 | 0.54 | | | 0.01 | 0.0352525 | | -0.01 | 0.02 | 1.51 | | | | |
| abp | 33 | 229.70 | | 51.83 | 228.48 | | | -1.22 | 6.3454536 | | -3.46 | 1.04 | -0.53 | | | | |
| abp | 33 | 212.39 | | 42.92 | 210.21 | | | -2.18 | 6.4159586 | | -4.46 | 0.09 | -1.03 | | | | |
| abp | 33 | 1076.20 | | 42.26 | 1081.52 | | | 5.32 | 14.876563 | | 0.04 | 10.59 | 0.49 | | | | |
| abp | 33 | 1338.39 | | 270.22 | 1330.02 | | | -8.37 | 57.983345 | | -28.9 | 12.19 | -0.63 | | | | |
| abp | 32 | 165.75 | | 29.37 | 164.78 | | | -0.97 | 3.4809048 | | -2.23 | 0.28 | -0.59 | | | | |
| abp | 32 | 548.68 | | 77.84 | 544.92 | | | -3.76 | 17.640282 | | -10.1 | 2.6 | -0.69 | | | | |
| abp | 32 | 307.22 | | 67.82 | 307.38 | | | 0.16 | 12.259442 | | -4.26 | 4.58 | 0.05 | | | | |
| abp | 31 | 59.05 | | 11.71 | 58.34 | | | -0.71 | 3.6395562 | | -2.04 | 0.63 | -1.20 | | | | |
| abp | 31 | 52.83 | | 9.62 | 52.42 | | | -0.41 | 2.9716227 | | -1.5 | 0.68 | -0.78 | | | | |
| abp | 31 | 1114.59 | | 32.56 | 1110.04 | | | -4.55 | 28.680248 | | -15.1 | 5.97 | -0.41 | | | | |
| abp | 31 | | | | | | | -0.60 | 14.094761 | | -5.77 | 4.57 | | | | | |
| abp | 32 | 58.39 | | 14.37 | 55.07 | | | -3.32 | 9.3193945 | | -6.68 | 0.04 | -5.69 | | | | |
| abp | 32 | 127.31 | | 32.12 | 120.95 | | | -6.36 | 32.936848 | | -18.2 | 5.51 | -5.00 | | | | |
| abp | 32 | 469.39 | | 91.44 | 473.01 | | | 3.62 | 86.592707 | | -27.6 | 34.84 | 0.77 | | | | |
| abp | 22 | 1.13 | | 0.08 | 1.12 | | 0.08 | -0.01 | 0.0358106 | | | | -1.24 | | | | |
| abp | 22 | 1.18 | | 0.15 | 1.20 | | 0.15 | 0.02 | 0.0679765 | | | | 1.35 | | | | |
| abp | 22 | 0.94 | | 0.13 | 0.93 | | 0.12 | -0.01 | 0.0552069 | | | | -0.95 | | | | |
| abp | 22 | 0.75 | | 0.10 | 0.76 | | 0.10 | 0.01 | 0.0438703 | | | | 1.47 | | | | |
| abp | 22 | 0.88 | | 0.14 | 0.90 | | 0.14 | 0.02 | 0.0619468 | | | | 1.70 | | | | |
| abp | 22 | 0.69 | | 0.05 | 0.70 | | 0.05 | 0.01 | 0.0239458 | | | | 1.30 | | | | |
| abp | 22 | 58.4 | | 9.90 | | | | | | | | | | | | | |
| abp | 22 | 21.45 | | | | | | | | | | | | | | | |
| abp | 22 | 27.4 | | 7.80 | | | | | | | | | | | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 22 | 42.4 | | | | | | | | | | | | | | | |
| itt | 23 | 714.50 | | 358.40 | | | | | | | | | | | | | |
| itt | 23 | 1.80 | | 1.70 | | | | | | | | | | | | | |
| itt | 23 | 28.80 | | 4.60 | 28.2 | | 3.90 | -0.60 | 2.0194059 | | | | -2.08 | | | | |
| itt | 23 | 41.80 | | 8.60 | 44.6 | | 8.60 | 2.80 | 3.8460369 | | | | 6.70 | | | | |
| itt | 23 | 38.80 | | 4.40 | 35.2 | | 5.50 | -3.60 | 2.4596748 | | | | -9.28 | | | | |
| itt | 23 | 5.50 | | 0.50 | 4.9 | | 0.30 | -0.60 | 0.2645751 | | | | -10.91 | | | | |
| itt | 23 | 26.30 | | 13.20 | 31.7 | | 12.80 | 5.40 | 5.8268345 | | | | 20.53 | | | | |
| itt | 23 | 76.20 | | 16.00 | 90.5 | | 15.10 | 14.30 | 7.0092796 | | | | 18.77 | | | | |
| itt | 23 | 50.50 | | 18.30 | 61.6 | | 14.90 | 11.10 | 8.1298216 | | | | 21.98 | | | | |
| itt | 23 | 123.00 | | 29.80 | 140.7 | | 31.10 | 17.70 | 13.676476 | | | | 14.39 | | | | |
| itt | 23 | 74.60 | | 23.40 | 94.4 | | 24.50 | 19.80 | 10.764293 | | | | 26.54 | | | | |
| itt | 23 | 0.68 | | 0.08 | 0.676 | | 0.09 | -0.01 | 0.0392428 | | | | -1.17 | | | | |
| itt | 23 | 0.65 | | 0.10 | 0.666 | | 0.11 | 0.02 | 0.0462061 | | | | 3.10 | | | | |
| itt | 23 | 1.04 | | 0.17 | 1.047 | | 0.16 | 0.01 | 0.0743398 | | | | 1.16 | | | | |
| itt | 23 | 0.86 | | 0.12 | 0.873 | | 0.13 | 0.01 | 0.057772 | | | | 1.63 | | | | |
| itt | 24 | 608.50 | | 248.80 | | | | | | | | | | | | | |
| itt | 24 | 2.30 | | 1.40 | | | | | | | | | | | | | |
| itt | 24 | 27.50 | | 3.80 | 27.5 | | 3.30 | 0.00 | 1.6607227 | | | | 0.00 | | | | |
| itt | 24 | 37.30 | | 5.20 | 37.2 | | 5.20 | -0.10 | 2.3255107 | | | | -0.27 | | | | |
| itt | 24 | 39.20 | | 4.50 | 38.4 | | 3.80 | -0.80 | 1.977372 | | | | -2.04 | | | | |
| itt | 24 | 5.90 | | 0.90 | 5.1 | | 0.60 | -0.80 | 0.4449719 | | | | -13.56 | | | | |
| itt | 24 | 28.80 | | 14.90 | 32.9 | | 9.50 | 4.10 | 7.580897 | | | | 14.24 | | | | |
| itt | 24 | 84.50 | | 21.50 | 81.2 | | 24.90 | -3.30 | 10.89174 | | | | -3.91 | | | | |
| itt | 24 | 47.20 | | 12.80 | 51.7 | | 11.80 | 4.50 | 5.5864121 | | | | 9.53 | | | | |
| itt | 24 | 137.70 | | 36.50 | 132.5 | | 28.20 | -5.20 | 16.575584 | | | | -3.78 | | | | |
| itt | 24 | 71.80 | | 19.00 | 77.1 | | 19.30 | 5.30 | 8.5691306 | | | | 7.38 | | | | |
| itt | 24 | 0.66 | | 0.11 | 0.66 | | 0.11 | 0.00 | 0.0486518 | | | | 0.46 | | | | |
| itt | 24 | 0.64 | | 0.10 | 0.641 | | 0.10 | 0.00 | 0.0440613 | | | | 0.47 | | | | |
| itt | 24 | 1.02 | | 0.14 | 1.02 | | 0.14 | 0.00 | 0.0632882 | | | | -0.20 | | | | |
| itt | 24 | 0.85 | | 0.13 | 0.849 | | 0.12 | 0.00 | 0.0556866 | | | | 0.12 | | | | |
| itt | 30 | 654.90 | | 200.80 | | | | | | | | | | | | | |
| itt | 30 | 1.60 | | 1.20 | | | | | | | | | | | | | |
| itt | 30 | 28.40 | | 3.70 | 28.4 | | 3.30 | 0.00 | 1.6130716 | | | | 0.00 | | | | |
| itt | 30 | 38.00 | | 2.90 | 35.9 | | 3.10 | -2.10 | 1.3557286 | | | | -5.53 | | | | |
| itt | 30 | 39.30 | | 5.50 | 40.6 | | 5.80 | 1.30 | 2.5436195 | | | | 3.31 | | | | |
| itt | 30 | 544.80 | | 67.40 | 555 | | 62.00 | 10.20 | 29.409522 | | | | 1.87 | | | | |
| itt | 30 | 24.70 | | 4.20 | 27 | | 3.20 | 2.30 | 1.9204166 | | | | 9.31 | | | | |
| itt | 30 | 5.80 | | 1.20 | 5 | | 0.80 | -0.80 | 0.5932959 | | | | -13.79 | | | | |
| itt | 30 | 28.30 | | 14.70 | 34.2 | | 12.50 | 5.90 | 6.4490309 | | | | 20.85 | | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| itt | 30 | 17.30 | | 4.40 | 19.8 | | 3.80 | 2.50 | 1.9245779 | | | | 14.45 | | | | |
| itt | 30 | 82.90 | | 20.60 | 90.9 | | 20.00 | 8.00 | 9.0972523 | | | | 9.65 | | | | |
| itt | 30 | 77.60 | | 18.60 | 79.8 | | 24.50 | 2.20 | 11.222745 | | | | 2.84 | | | | |
| itt | 30 | 51.10 | | 15.40 | 55.1 | | 16.10 | 4.00 | 7.0765811 | | | | 7.83 | | | | |
| itt | 30 | 49.90 | | 14.00 | 56.8 | | 14.40 | 6.90 | 6.3623895 | | | | 13.83 | | | | |
| itt | 30 | 137.60 | | 27.50 | 141.9 | | 34.80 | 4.30 | 15.64257 | | | | 3.13 | | | | |
| itt | 30 | 126.50 | | 36.50 | 135.5 | | 30.90 | 9.00 | 16.029036 | | | | 7.11 | | | | |
| itt | 30 | 68.90 | | 19.10 | 75.1 | | 20.20 | 6.20 | 8.8529091 | | | | 9.00 | | | | |
| itt | 30 | 72.50 | | 18.00 | 79.5 | | 20.50 | 7.00 | 8.9470666 | | | | 9.66 | | | | |
| itt | 30 | 0.70 | | 0.09 | 0.717 | | 0.09 | 0.02 | 0.0397869 | | | | 2.58 | | | | |
| itt | 30 | 0.62 | | 0.08 | 0.628 | | 0.08 | 0.01 | 0.0356735 | | | | 1.13 | | | | |
| itt | 30 | 0.99 | | 0.14 | 0.989 | | 0.15 | 0.00 | 0.0652518 | | | | 0.30 | | | | |
| itt | 30 | 0.83 | | 0.10 | 0.832 | | 0.10 | 0.00 | 0.0462969 | | | | 0.48 | | | | |
| itt | 30 | 0.86 | | 0.10 | 0.868 | | 0.09 | 0.01 | 0.0428089 | | | | 1.28 | | | | |
| abp | 20 | 1.00 | | 0.13 | 0.99 | | 0.13 | -0.01 | 0.0578705 | | | | -0.48 | 3.63 | | | |
| abp | 20 | 68.9 | | 11.50 | 68.5 | | 11.20 | -0.40 | 5.0842895 | | | | -0.58 | | | | |
| abp | 20 | 26.16 | | | 26 | | | -0.16 | | | | | -0.61 | | | | |
| abp | 20 | 23.2 | | 4.40 | 25 | | 4.10 | 1.80 | 1.9230185 | | | | 7.76 | | | | |
| abp | 16 | 1.05 | | 0.17 | 1.06 | | 0.17 | 0.01 | 0.0771505 | | | | 0.81 | 4.53 | | | |
| abp | 16 | 65.6 | | 11.90 | 64.5 | | 11.00 | -1.10 | 5.1951901 | | | | -1.68 | | | | |
| abp | 16 | 25.95 | | | 25.51 | | | -0.44 | | | | | -1.70 | | | | |
| abp | 16 | 24.2 | | 4.70 | 26.1 | | 5.00 | 1.90 | 2.1886069 | | | | 7.85 | | | | |
| itt | 20 | 0.85 | | 0.13 | 0.86 | | | 0.01 | 0.039 | | | | 0.90 | 4.50 | | | |
| itt | 20 | 1.02 | | 0.16 | 1.03 | | | 0.01 | 0.033 | | | | 1.00 | 3.60 | | | |
| itt | 20 | 64.7 | | 7.70 | | | | | | | | | | | | | |
| itt | 20 | 24.4 | | 2.50 | | | | | | | | | | | | | |
| itt | 20 | 724 | | 350.00 | 931 | | 378.00 | 207.00 | 165.05757 | | | | 28.59 | | | | |
| itt | 20 | 84.70 | | 14.10 | 111.6 | | 19.10 | 26.90 | 8.8804279 | | | | 35.20 | | | | |
| itt | 20 | 22.10 | | 6.20 | 37.8 | | 10.40 | 15.70 | 5.5259388 | | | | 72.40 | | | | |
| itt | 20 | 18.50 | | 4.10 | 32.4 | | 5.10 | 13.90 | 2.2764007 | | | | 76.30 | | | | |
| itt | 20 | 27.60 | | 6.80 | 37.8 | | 7.60 | 10.20 | 3.3130047 | | | | 43.50 | | | | |
| itt | 20 | 14.30 | | 5.10 | 20.4 | | 5.10 | 6.10 | 2.2807893 | | | | 42.60 | | | | |
| itt | 20 | 24.60 | | 5.80 | 20.4 | | 5.20 | -4.20 | 2.5282405 | | | | -14.30 | | | | |
| itt | 20 | 6762.00 | | 1046.00 | 8610 | | 1109.00 | 1848.00 | 485.76929 | | | | | | | | |
| abp | 23 | 69.00 | | 12.40 | | | | | | | | | | | | | |
| abp | 23 | 25.90 | | 4.40 | | | | | | | | | | | | | |
| abp | 23 | 0.73 | 0.01 | 0.05 | 0.73 | 0.01 | 0.05 | 0.00 | 0.0214476 | | | | 0.00 | | | | |
| abp | 23 | 0.88 | 0.02 | 0.10 | 0.89 | 0.02 | 0.10 | 0.01 | 0.0428952 | | | | 1.14 | | | | |
| abp | 23 | 1.01 | 0.02 | 0.10 | 1.02 | 0.02 | 0.10 | 0.01 | 0.0428952 | | | | 0.99 | | | | |
| abp | 31 | 862.00 | | 145.00 | 864.73 | | | 2.73 | | | | | 0.32 | 1.42 | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| abp | 31 | 849.00 | | 121.00 | 851.76 | | | 2.76 | | | | | 0.33 | 1.77 | | | |
| abp | 31 | 657.00 | | 89.00 | 649.58 | | | -7.42 | | | | | -1.13 | 2.15 | | | |
| abp | 31 | 629.00 | | 87.00 | 634.09 | | | 5.09 | | | | | 0.81 | 2.29 | | | |
| abp | 31 | 1001.00 | | 161.00 | 1003.30 | | | 2.30 | | | | | 0.23 | 1.79 | | | |
| abp | 31 | 694.00 | | 103.00 | 695.94 | | | 1.94 | | | | | 0.28 | 1.92 | | | |
| abp | 31 | 641.00 | | 92.00 | 633.31 | | | -7.69 | | | | | -1.20 | 2.35 | | | |
| abp | 31 | 623.00 | | 101.00 | 616.46 | | | -6.54 | | | | | -1.05 | 2.26 | | | |
| abp | 20 | 68.40 | | 12.00 | 68.5 | | 12.00 | 0.10 | 5.3665631 | | | | 0.15 | | | | |
| abp | 20 | 0.82 | | 0.11 | 0.83 | | 0.12 | 0.01 | 0.052345 | | | | 1.22 | | | | |
| abp | 20 | 0.69 | | 0.13 | 0.7 | | 0.11 | 0.01 | 0.0570964 | | | | 1.45 | | | | |
| abp | 20 | 0.74 | | 0.10 | 0.75 | | 0.11 | 0.01 | 0.0479583 | | | | 1.35 | | | | |
| abp | 20 | 1.10 | | 0.17 | 1.13 | | 0.18 | 0.03 | 0.078867 | | | | 2.73 | | | | |
| abp | 20 | 24.60 | | 3.80 | 26.7 | | 3.60 | 2.10 | 1.6661332 | | | | 8.54 | | | | |
| abp | 20 | 13.40 | | 2.30 | 17.3 | | 2.80 | 3.90 | 1.2401613 | | | | 29.10 | | | | |
| abp | 20 | 99.50 | | 10.20 | 118.5 | | 9.30 | 19.00 | 4.447696 | | | | 19.10 | | | | |
| abp | 20 | 4.30 | | 0.90 | 6.6 | | 0.80 | 2.30 | 0.3924283 | | | | 53.49 | | | | |
| abp | 20 | 22.00 | | 4.20 | 33 | | 4.40 | 11.00 | 1.9328735 | | | | 50.00 | | | | |
| abp | 20 | 29.50 | | 4.80 | 33.5 | | 4.30 | 4.00 | 2.0923671 | | | | 13.56 | | | | |
| itt | 26 | 36.90 | | 5.40 | | | | | | | | | | | | | |
| itt | 26 | 17.40 | | 3.50 | 18.8 | | | 1.40 | 1 | | | | 8.05 | | | | |
| itt | 26 | 99.20 | | 17.40 | 98.7 | | | -0.50 | 3.6 | | | | -0.50 | | | | |
| itt | 26 | 57.60 | | 13.70 | 58.9 | | | 1.30 | 1.6 | | | | 2.26 | | | | |
| itt | 26 | 41.60 | | 9.40 | 39.8 | | | -1.80 | 1.9 | | | | -4.33 | | | | |
| itt | 26 | 0.96 | | 0.15 | 0.971 | | | 0.01 | 0.014 | | | | 1.36 | | | | |
| itt | 26 | 519.00 | | 187.00 | 693 | | | 174.00 | 166 | | | | 33.53 | | | | |
| itt | 26 | 10.90 | | 3.30 | 9.4 | | | -1.50 | 1.4 | | | | -13.76 | | | | |
| itt | 26 | 13.40 | | 10.40 | 16.8 | | | 3.40 | 5.9 | | | | 25.37 | | | | |
| itt | 26 | 1.16 | | 0.12 | 1.17 | | | 0.01 | 0.023 | | | | 0.60 | | | | |
| itt | 26 | 1.08 | | 0.16 | 1.083 | | | 0.01 | 0.027 | | | | 0.74 | | | | |
| itt | 65 | 72.00 | | 15.00 | | | | | | | | | | | | | |
| itt | 65 | 15.00 | | 3.00 | | | | | | | | | | | | | |
| itt | 65 | 0.84 | | 0.18 | 0.85 | | 0.19 | 0.01 | 0.0833067 | | | | 1.19 | | | | |
| itt | 65 | 0.65 | | 0.17 | 0.65 | | 0.17 | 0.00 | 0.0760263 | | | | 0.00 | | | | |
| itt | 65 | 0.70 | | 0.15 | 0.7 | | 0.17 | 0.00 | 0.074162 | | | | 0.00 | | | | |
| itt | 65 | 1.09 | | 0.26 | 1.08 | | 0.28 | -0.01 | 0.1223111 | | | | -0.92 | | | | |
| itt | 65 | 1.09 | | 0.16 | 1.09 | | 0.18 | 0.00 | 0.0784857 | | | | 0.00 | | | | |
| itt | 65 | 792.00 | | 282.00 | 1286 | | 322.00 | 494.00 | 140.57311 | | | | 62.37 | | | | |
| itt | 65 | 147.00 | | 94.00 | 613 | | 119.00 | 466.00 | 53.499533 | | | | 317.01 | | | | |
| itt | 72 | 88.80 | 2.10 | 17.82 | 93.00 | | | 4.20 | 11.879394 | 1.4 | | | 4.73 | | | | |
| itt | 72 | 295.00 | 5.80 | 49.21 | 323.50 | | | 28.50 | 61.942554 | 7.3 | | | 9.66 | | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| itt | 72 | 81.60 | 1.10 | 9.33 | 82.90 | | | 1.30 | 5.939697 | 0.7 | | | 1.59 | | | | |
| itt | 72 | 34.90 | 0.80 | 6.79 | 34.30 | | | -0.60 | 5.0911688 | 0.6 | | | -1.72 | | | | |
| itt | 72 | 43.30 | 0.50 | 4.24 | 45.00 | | | 1.70 | 2.5455844 | 0.3 | | | 3.93 | | | | |
| itt | 72 | 0.85 | 0.01 | 0.08 | 0.86 | 0.01 | 0.08 | 0.01 | 0.0379473 | | | | 1.18 | | | | |
| itt | 72 | 1.07 | 0.01 | 0.08 | 1.07 | 0.01 | 0.08 | 0.00 | 0.0379473 | | | | 0.00 | | | | |
| itt | 72 | 1.09 | 0.01 | 0.08 | 1.09 | 0.01 | 0.08 | 0.00 | 0.0379473 | | | | | | | | |
| itt | 72 | 1.29 | 0.02 | 0.17 | 1.29 | 0.02 | 0.17 | 0.00 | 0.0758947 | | | | | | | | |
| abp | 45 | | | | | | | | | | | | | | | | |
| abp | 22 | | | | | | | | | | | | | | | | |
| abp | 28 | | | | | | | | | | | | | | | | |
| abp | 28 | 1.24 | | 0.12 | | | | | | | | | 0.97 | 3.23 | 0.61 | | |
| abp | 28 | 0.69 | | 0.06 | | | | | | | | | -0.77 | 3.70 | 0.70 | | |
| abp | 28 | 1.01 | | 0.12 | | | | | | | | | -1.49 | 3.23 | 0.61 | | |
| abp | 28 | 0.79 | | 0.12 | | | | | | | | | -0.99 | 4.55 | 0.86 | | |
| abp | 28 | 0.97 | | 0.16 | | | | | | | | | -1.33 | 5.87 | 1.11 | | |
| abp | 28 | 60.15 | | 9.96 | | | | | | | | | | | | | |
| abp | 28 | 914.00 | | 403.21 | | | | | | | | | | | | | |
| itt | 14 | 61.70 | | 10.80 | | | | | | | | | | | | | |
| itt | 10 | 0.97 | | 0.17 | 0.978 | | 0.17 | 0.01 | 0.035 | | | | 0.93 | | | | |
| itt | 10 | 0.73 | | 0.12 | 0.717 | | 0.13 | -0.01 | 0.026 | | | | -1.24 | | | | |
| abp | 31 | 54.10 | | 7.30 | 53.1 | | 7.30 | -1.00 | 3.2646592 | | | | -1.85 | | | | |
| abp | 31 | 22.40 | | 2.90 | 22.1 | | 2.90 | -0.30 | 1.2969194 | | | | -1.34 | | | | |
| abp | 31 | 723.80 | | 221.50 | 693 | | 220.30 | -30.80 | 98.796407 | | | | -4.26 | | | | |
| abp | 31 | 12.30 | | 13.10 | 6.3 | | 3.40 | -6.00 | 10.148793 | | | | -48.78 | | | | |
| abp | 31 | 0.98 | | 0.10 | 0.976 | | 0.10 | 0.00 | 0.0438748 | | | | -0.26 | 1.58 | | | |
| abp | 31 | 37.90 | | 4.20 | 38 | | 4.30 | 0.10 | 1.9031553 | | | | 0.23 | 2.27 | | | |
| abp | 31 | 16.80 | | 4.30 | 16.2 | | 4.20 | -0.60 | 1.9031553 | | | | -3.37 | 6.35 | | | |
| abp | 31 | 0.88 | | 0.12 | 0.866 | | 0.11 | -0.01 | 0.0532748 | | | | -1.30 | 2.26 | | | |
| abp | 31 | 0.78 | | 0.11 | 0.775 | | 0.11 | -0.01 | 0.0501019 | | | | -0.60 | 2.31 | | | |
| abp | 31 | 0.67 | | 0.12 | 0.667 | | 0.11 | 0.00 | 0.0508724 | | | | -0.39 | 4.09 | | | |
| abp | 31 | 0.59 | | 0.10 | 0.589 | | 0.09 | 0.00 | 0.0428089 | | | | -0.31 | 3.44 | | | |
| abp | 6 | 96.21 | | 0.86 | 7.82 | 0.00 | 0.88 | 0.02 | 0.3916102 | | | | -1.04 | | | | |
| abp | 6 | 31.40 | | 5.50 | 31.1 | | 5.60 | -0.40 | 0.7 | | | | -1.27 | | | | |
| abp | 6 | 1.11 | | 0.09 | 1.1293 | | 0.10 | 0.02 | 0.0328 | | | | 2.10 | | | | |
| abp | 6 | 0.77 | | 0.34 | 0.9312 | | 0.08 | 0.16 | 0.3492 | | | | 20.25 | | | | |
| abp | 6 | 0.86 | | 0.06 | 0.8548 | | 0.05 | -0.01 | 0.0294 | | | | -0.78 | | | | |

Outcome Characteristics

| met_sd_e | p_met_sd_e | n_c | i_c | i_se_c | i_sd_c | f_c | f_se_c | f_sd_c | d_c | d_sd_c | d_se_c | lci_c | uci_c | p_c |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | confidence interval | 19 | | | | | | | | | | | | -0.30 |
| | confidence interval | 19 | | | | | | | | | | | | 0.10 |
| | confidence interval | 19 | | | | | | | | | | | | -0.70 |
| | confidence interval | 19 | | | | | | | | | | | | 0.20 |
| confidence interval | | 19 | 62.6 | | 9.50 | 60.7 | | | -1.90 | 4.88 | | -4.2 | 0.5 | -3.04 |
| | | 19 | 23.9 | | 3.50 | | | | | | | | | |
| | | 19 | 29.7 | | 5.00 | | | | | | | | | |
| | confidence interval | 19 | | | | | | | | | | | | -0.30 |
| | confidence interval | 19 | | | | | | | | | | | | 0.10 |
| | confidence interval | 19 | | | | | | | | | | | | -0.70 |
| | confidence interval | 19 | | | | | | | | | | | | 0.20 |
| confidence interval | | 19 | 62.6 | | 9.50 | 60.7 | | | -1.90 | 4.88 | | -4.2 | 0.5 | -3.04 |
| | | 19 | 23.9 | | 3.50 | | | | | | | | | |
| | | 19 | 29.7 | | 5.00 | | | | | | | | | |
| | confidence interval | 19 | | | | | | | | | | | | -0.30 |
| | confidence interval | 19 | | | | | | | | | | | | 0.10 |
| | confidence interval | 19 | | | | | | | | | | | | -0.70 |
| | confidence interval | 19 | | | | | | | | | | | | 0.20 |
| confidence interval | | 19 | 62.6 | | 9.50 | 60.7 | | | -1.90 | 4.88 | | -4.2 | 0.5 | -3.04 |
| | | 19 | 23.9 | | 3.50 | | | | | | | | | |
| | | 19 | 29.7 | | 5.00 | | | | | | | | | |
| change score sd (imputed) | | 25 | 1.22 | | 0.10 | 1.23 | | 0.11 | 0.01 | 0.02 | | | | 1.06 |
| change score sd (imputed) | | 25 | 0.99 | | 0.09 | 1.00 | | 0.11 | 0.00 | 0.04 | | | | 0.40 |
| change score sd (imputed) | | 25 | 0.82 | | 0.09 | 0.82 | | 0.11 | 0.00 | 0.04 | | | | 0.37 |
| pre-post sd | | 25 | 62.7 | | 2.00 | 62.7 | | 2.00 | 0.00 | 0.89 | | | | 0.00 |
| pre-post sd | | 25 | 23.2 | | 3.20 | 23.2 | | 3.20 | 0.00 | 1.43 | | | | 0.00 |
| change score sem | | 25 | 194 | | 55.00 | | | | 8.60 | 22.50 | 4.5 | | | 4.43 |
| change score sem | | 25 | 40 | | 6.00 | | | | 2.40 | 3.80 | 0.76 | | | 6.00 |
| change score sd (imputed) | | 32 | 1.12 | | 0.12 | 1.12 | | 0.12 | 0.00 | 0.04 | | | | -0.09 |
| change score sd (imputed) | | 32 | 0.93 | | 0.13 | 0.92 | | 0.11 | -0.01 | 0.03 | | | | -0.54 |
| change score sd (imputed) | | 32 | 0.79 | | 0.11 | 0.79 | | 0.10 | -0.01 | 0.03 | | | | -0.76 |
| pre-post sd | | 32 | 66.5 | | 7.80 | 66.5 | | 7.80 | 0.00 | 3.49 | | | | 0.00 |
| pre-post sd | | 32 | 25.1 | | 2.60 | 25.1 | | 2.60 | 0.00 | 1.16 | | | | 0.00 |
| pre-post sd | | 32 | 1139 | | 340.00 | 1139 | | 340.00 | 0.00 | 152.05 | | | | 0.00 |
| change score sd (imputed) | | 22 | 1.15 | | 0.12 | 1.16 | | 0.12 | 0.02 | 0.02 | | | | 1.57 |
| change score sd (imputed) | | 22 | 0.89 | | 0.11 | 0.89 | | 0.11 | 0.00 | 0.03 | | | | -0.11 |
| change score sd (imputed) | | 22 | 0.77 | | 0.11 | 0.77 | | 0.12 | 0.00 | 0.03 | | | | -0.52 |
| pre-post sd | | 22 | 63.8 | | 9.20 | 63.8 | | 9.20 | 0.00 | 4.11 | | | | 0.00 |
| pre-post sd | | 22 | 24.6 | | 2.57 | 24.6 | | 2.57 | 0.00 | 1.15 | | | | 0.00 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pre-post sd | | 22 | 1190 | | 336.00 | 1190 | | 336.00 | 0.00 | 150.26 | | | | 0.00 |
| change score sem | | 22 | 39 | | 6.60 | | | | 5.80 | 6.10 | 1.3 | | | 14.87 |
| | | 44 | 24.9 | | 2.30 | | | | | | | | | |
| pre-post sd | | 44 | 18.8 | | 5.60 | 16.8 | | 5.10 | -2.00 | 2.44 | | | | -10.64 |
| pre-post sd | | 44 | 1.021 | | 0.11 | 1.014 | | 0.11 | -0.01 | 0.05 | | | | -0.69 |
| pre-post sd | | 44 | 1.049 | | 0.12 | 1.042 | | 0.12 | -0.01 | 0.05 | | | | -0.67 |
| pre-post sd | | 44 | 0.869 | | 0.08 | 0.866 | | 0.08 | 0.00 | 0.04 | | | | -0.35 |
| pre-post sd | | 44 | 0.826 | | 0.09 | 0.832 | | 0.09 | 0.01 | 0.04 | | | | 0.73 |
| pre-post sd | | 52 | 18.8 | | 5.60 | 16.8 | | 5.10 | -2.00 | 2.44 | | | | -10.64 |
| pre-post sd | | 52 | 1.007 | | 0.11 | 1.002 | | 0.11 | 0.00 | 0.05 | | | | -0.50 |
| pre-post sd | | 52 | 1.033 | | 0.12 | 1.028 | | 0.12 | 0.00 | 0.05 | | | | -0.48 |
| pre-post sd | | 52 | 0.875 | | 0.08 | 0.874 | | 0.08 | 0.00 | 0.04 | | | | -0.11 |
| pre-post sd | | 52 | 0.832 | | 0.09 | 0.834 | | 0.09 | 0.00 | 0.04 | | | | 0.24 |
| | | 15 | 24.61 | | 2.32 | | | | | | | | | |
| change score sem | | 15 | 1.18 | | 0.20 | 1.15 | | | -0.03 | 0.04 | 0.01 | | | -2.54 |
| pre-post sd | | 15 | 0.955 | | 0.10 | 0.942 | | 0.15 | -0.01 | 0.07 | | | | -1.36 |
| | | 15 | | | | | | | | | | | | |
| pre-post sd | change score sem | 10 | 0.706 | 0.001 | 0.00 | 0.695 | 0.001 | 0.00 | -0.01 | 0.00 | | | | -1.58 |
| pre-post sd | change score sem | 10 | 0.882 | 0.002 | 0.01 | 0.873 | 0.002 | 0.01 | -0.01 | 0.00 | | | | -0.98 |
| pre-post sd | | 10 | 39 | 8 | 25.30 | 38 | 7 | 22.14 | -1.00 | 11.05 | | | | -2.56 |
| pre-post sd | | 10 | 22 | 7 | 22.14 | 23 | 5 | 15.81 | 1.00 | 10.49 | | | | 4.55 |
| pre-post sd | | 10 | 69 | 22.14 | 70.01 | 69 | 18.97 | 59.99 | 0.00 | 30.67 | | | | 0.00 |
| pre-post sd | | 10 | 27 | 18.97 | 59.99 | 28 | 22.14 | 70.01 | 1.00 | 30.67 | | | | 3.70 |
| pre-post sd | | 10 | 31 | 9.49 | 30.01 | 32 | 18.87 | 59.67 | 1.00 | 35.19 | | | | 3.23 |
| pre-post sd | | 9 | 61.4 | | 5.90 | 62.8 | | 5.30 | 1.40 | 2.57 | | | | 2.28 |
| pre-post sd | | 9 | 21 | | 4.80 | 22 | | 4.60 | 1.00 | 2.11 | | | | 4.76 |
| change score sd (imputed) | | 9 | 21.033 | | 1.50 | 21.578 | | 1.73 | 0.54 | 1.07 | | | | 2.59 |
| change score sd (imputed) | | 9 | 508.89 | | 49.28 | 517.89 | | 40.62 | 9.00 | 49.82 | | | | 1.77 |
| change score sd (imputed) | | 9 | 7 | | 0.93 | 7.125 | | 0.88 | 0.13 | 0.35 | | | | 1.79 |
| change score sd (imputed) | | 9 | 41.889 | | 7.25 | 42.622 | | 7.02 | 0.73 | 2.41 | | | | 1.75 |
| change score sd (imputed) | | 9 | 110.67 | | 21.14 | 113.44 | | 22.15 | 2.78 | 4.74 | | | | 2.51 |
| change score sd (imputed) | | 9 | 0.8539 | | 0.13 | 0.86011 | | 0.13 | 0.01 | 0.01 | | | | 0.73 |
| change score sd (imputed) | | 9 | 0.691 | | 0.08 | 0.69678 | | 0.08 | 0.01 | 0.01 | | | | 0.84 |
| change score sd (imputed) | | 9 | 0.5707 | | 0.07 | 0.57367 | | 0.07 | 0.00 | 0.00 | | | | 0.53 |
| change score sd (imputed) | | 9 | 0.4737 | | 0.07 | 0.48389 | | 0.07 | 0.01 | 0.02 | | | | 2.15 |
| change score sd (imputed) | | 9 | 0.9454 | | 0.08 | 0.94933 | | 0.08 | 0.00 | 0.01 | | | | 0.41 |
| pre-post sd | | 9 | 61.4 | | 5.90 | 62.8 | | 5.30 | 1.40 | 2.57 | | | | 2.28 |
| pre-post sd | | 9 | 21 | | 4.80 | 22 | | 4.60 | 1.00 | 2.11 | | | | 4.76 |
| change score sd (imputed) | | 9 | 21.033 | | 1.50 | 21.578 | | 1.73 | 0.54 | 1.07 | | | | 2.59 |
| change score sd (imputed) | | 9 | 508.89 | | 49.28 | 517.89 | | 40.62 | 9.00 | 49.82 | | | | 1.77 |

Outcome Characteristics

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| change score sd (imputed) | | 9 | 7 | | 0.93 | 7.125 | | 0.88 | 0.13 | 0.35 | | | | 1.79 |
| change score sd (imputed) | | 9 | 41.889 | | 7.25 | 42.622 | | 7.02 | 0.73 | 2.41 | | | | 1.75 |
| change score sd (imputed) | | 9 | 110.67 | | 21.14 | 113.44 | | 22.15 | 2.78 | 4.74 | | | | 2.51 |
| change score sd (imputed) | | 9 | 0.8539 | | 0.13 | 0.86011 | | 0.13 | 0.01 | 0.01 | | | | 0.73 |
| change score sd (imputed) | | 9 | 0.691 | | 0.08 | 0.69678 | | 0.08 | 0.01 | 0.01 | | | | 0.84 |
| change score sd (imputed) | | 9 | 0.5707 | | 0.07 | 0.57367 | | 0.07 | 0.00 | 0.00 | | | | 0.53 |
| change score sd (imputed) | | 9 | 0.4737 | | 0.07 | 0.48389 | | 0.07 | 0.01 | 0.02 | | | | 2.15 |
| change score sd (imputed) | | 9 | 0.9454 | | 0.08 | 0.94933 | | 0.08 | 0.00 | 0.01 | | | | 0.41 |
| change score sd (imputed) | | 40 | 1.04 | | 0.20 | 1.03 | | 0.20 | 0.00 | 0.09 | | | | -0.48 |
| change score sd (imputed) | | 40 | 0.84 | | 0.11 | 0.85 | | 0.11 | 0.01 | 0.05 | | | | 1.31 |
| change score sd (imputed) | | 40 | 0.53 | | 0.11 | 0.52 | | 0.11 | -0.01 | 0.05 | | | | -1.89 |
| | | 40 | 67.9 | | 10.60 | 68.8 | | | 0.90 | 1.90 | | | | 1.33 |
| | | 40 | 25.6 | | 3.50 | 25.93 | | | 0.33 | | | | | 1.29 |
| pre-post sd | | 40 | 841 | | 240.00 | 853 | | 272.00 | 12.00 | 118.66 | | | | 1.43 |
| | | 12 | 73.2 | 4.8 | 16.63 | | | | | | | | | |
| | | 12 | 26.6 | 1.2 | 4.16 | | | | | | | | | |
| | | 12 | 40 | 2 | 6.93 | | | | | | | | | |
| | | 12 | 1019 | 115 | 398.37 | | | | | | | | | |
| | | 12 | 8.1 | 2.2 | 7.62 | | | | | | | | | |
| pre-post sd | change score sem | 12 | 0.939 | 0.033 | 0.11 | 0.937 | 0.031 | 0.11 | 0.00 | 0.05 | | | | -0.10 |
| pre-post sd | change score sem | 12 | 0.847 | 0.03 | 0.10 | 0.841 | 0.03 | 0.10 | -0.01 | 0.05 | | | | -0.70 |
| pre-post sd | change score sem | 12 | 0.721 | 0.025 | 0.09 | 0.718 | 0.026 | 0.09 | 0.00 | 0.04 | | | | -0.40 |
| pre-post sd | change score sem | 12 | 0.662 | 0.022 | 0.08 | 0.661 | 0.023 | 0.08 | 0.00 | 0.04 | | | | -0.20 |
| pre-post sd | change score sem | 12 | 0.566 | 0.023 | 0.08 | 0.571 | 0.025 | 0.09 | 0.01 | 0.04 | | | | 0.80 |
| pre-post sd | change score sem | 12 | 0.991 | 0.016 | 0.06 | 0.986 | 0.016 | 0.06 | -0.01 | 0.02 | | | | -0.50 |
| pre-post sd | change score sem | 12 | 31.4 | 4.6 | 15.93 | 29.3 | 5.1 | 17.67 | -2.10 | 7.70 | | | | -2.00 |
| pre-post sd | change score sem | 12 | 110.6 | 9.2 | 31.87 | 114 | 8.9 | 30.83 | 3.40 | 14.06 | | | | 4.00 |
| pre-post sd | | 22 | 79.5 | | 9.20 | 79 | | 8.40 | -0.50 | 4.01 | | | | -0.63 |
| pre-post sd | | 22 | 31 | | 2.90 | 30.8 | | 2.90 | -0.20 | 1.30 | | | | -0.65 |
| pre-post sd | | 22 | 35.4 | | 7.30 | 35.2 | | 6.90 | -0.20 | 3.20 | | | | -0.56 |
| pre-post sd | | 22 | 41.1 | | 3.60 | 40.9 | | 3.90 | -0.20 | 1.70 | | | | -0.49 |
| pre-post sd | | 22 | 45.9 | | 5.00 | 46 | | 4.80 | 0.10 | 2.20 | | | | 0.22 |
| pre-post sd | | 22 | 1.13 | | 0.06 | 1.12 | | 0.06 | -0.01 | 0.03 | | | | -0.88 |
| pre-post sd | | 22 | 1.07 | | 0.14 | 1.09 | | 0.13 | 0.02 | 0.06 | | | | 1.87 |
| pre-post sd | | 22 | 1 | | 0.08 | 1 | | 0.08 | 0.00 | 0.04 | | | | 0.00 |
| pre-post sd | | 22 | 0.92 | | 0.09 | 0.91 | | 0.09 | -0.01 | 0.04 | | | | -1.09 |
| pre-post sd | | 22 | 0.84 | | 0.07 | 0.84 | | 0.06 | 0.00 | 0.03 | | | | 0.00 |
| pre-post sd | | 22 | 0.76 | | 0.10 | 0.8 | | 0.10 | 0.04 | 0.04 | | | | 5.26 |
| pre-post sd | | 19 | 67.7 | | 8.50 | 67.8 | | 8.50 | 0.10 | 3.80 | | | | 0.15 |
| pre-post sd | | 19 | 26.1 | | 3.20 | 26.4 | | 3.40 | 0.30 | 1.49 | | | | 1.15 |

Outcome Characteristics

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pre-post sd | | 19 | 38.8 | | 3.30 | 37.6 | | 3.40 | -1.20 | 1.50 | | | | -3.09 |
| pre-post sd | | 19 | 0.98 | | 0.10 | 1 | | 0.10 | 0.02 | 0.04 | | | | 2.00 |
| pre-post sd | | 19 | 0.68 | | 0.07 | 0.69 | | 0.08 | 0.01 | 0.03 | | | | 1.50 |
| pre-post sd | | 19 | 0.95 | | 0.15 | 0.96 | | 0.15 | 0.01 | 0.07 | | | | 1.00 |
| pre-post sd | | 19 | 0.78 | | 0.10 | 0.78 | | 0.10 | 0.00 | 0.04 | | | | 0.00 |
| pre-post sd | | 19 | 0.68 | | 0.11 | 0.7 | | 0.11 | 0.02 | 0.05 | | | | 2.90 |
| pre-post sd | | 19 | 0.64 | | 0.10 | 0.62 | | 0.12 | -0.02 | 0.05 | | | | -3.10 |
| pre-post sd | | 19 | 284.19 | | 38.98 | 277.03 | | 51.71 | -7.16 | 23.77 | | | | -2.50 |
| pre-post sd | | 19 | 238.02 | | 49.24 | 235.16 | | 41.21 | -2.86 | 21.69 | | | | -1.20 |
| pre-post sd | | 19 | 1.79 | | 0.26 | 1.86 | | 0.31 | 0.07 | 0.14 | | | | 3.90 |
| pre-post sd | | 19 | 42.89 | | 44.64 | 61.22 | | 48.78 | 18.33 | 21.28 | | | | 42.70 |
| pre-post sd | | 19 | 54.79 | | 2.30 | 54.58 | | 2.34 | -0.21 | 1.04 | | | | -0.40 |
| | | 31 | 65.09 | | 15.42 | | | | | | | | | |
| | | 31 | 33.3 | | 5.90 | | | | | | | | | |
| | change score sd (imputed) | 31 | 1.06 | | 0.12 | | | 0.00 | -1.06 | | | | | 0.20 |
| | change score sd (imputed) | 31 | 0.84 | | | | | | -0.84 | | | | | -1.90 |
| | change score sd (imputed) | 31 | 0.69 | | 0.06 | | | | -0.69 | | | | | 0.30 |
| change score sd (imputed) | change score sd (imputed) | 31 | 35.4 | | 6.60 | | | | -1.80 | 6.00 | | | | -4.00 |
| change score sd (imputed) | change score sd (imputed) | 31 | 51.2 | | 16.00 | | | | 0.87 | 5.80 | | | | 6.00 |
| change score sd (imputed) | change score sd (imputed) | 31 | 36.3 | | 11.40 | | | | 2.10 | 4.90 | | | | 13.90 |
| change score sd (imputed) | change score sd (imputed) | 31 | 75 | | 28.90 | | | | 4.40 | 12.10 | | | | 15.40 |
| change score sd (imputed) | change score sd (imputed) | 31 | 91.8 | | 26.50 | | | | 0.03 | 13.00 | | | | 4.20 |
| | | 65 | 68.3 | | 10.80 | | | | | | | | | |
| | | 65 | 25.6 | | 4.00 | | | | | | | | | |
| | | 65 | 38.5 | | 4.40 | | | | | | | | | |
| | | 65 | 38.6 | | 7.20 | | | | | | | | | |
| change score sd (imputed) | | 65 | 0.89 | | 0.11 | 0.897 | | | 0.01 | 0.03 | | | | 0.79 |
| change score sd (imputed) | | 65 | 0.77 | | 0.10 | 0.77 | | | 0.00 | 0.03 | | | | 0.00 |
| change score sd (imputed) | | 65 | 1.17 | | 0.13 | 1.181 | | | 0.01 | 0.03 | | | | 0.94 |
| change score sd (imputed) | | 65 | 1.13 | | 0.07 | 1.134 | | | 0.00 | 0.01 | | | | 0.35 |
| | | 59 | 67.8 | | 11.40 | | | | | | | | | |
| | | 59 | 25.5 | | 4.00 | | | | | | | | | |
| | | 59 | 38.3 | | 4.10 | | | | | | | | | |
| | | 59 | 38.5 | | 7.30 | | | | | | | | | |
| change score sd (imputed) | | 59 | 0.85 | | 0.10 | 0.846 | | | 0.00 | 0.04 | | | | -0.47 |
| change score sd (imputed) | | 59 | 0.72 | | 0.10 | 0.719 | | | 0.00 | 0.03 | | | | -0.14 |
| change score sd (imputed) | | 59 | 1.08 | | 0.15 | 1.074 | | | -0.01 | 0.03 | | | | -0.56 |
| change score sd (imputed) | | 59 | 1.09 | | 0.08 | 1.086 | | | 0.00 | 0.01 | | | | -0.37 |
| pre-post sd | | 5 | 1.15 | | 0.12 | 1.08 | | 0.15 | -0.07 | 0.07 | | | | -6.09 |
| pre-post sd | | 5 | 70.5 | | 10.12 | 69.3 | | 9.27 | -1.20 | 4.41 | | | | -1.70 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pre-post sd | | 5 | 42 | | 6.73 | 45.1 | | 4.96 | 3.10 | 3.13 | | | | 7.38 |
| | | 5 | 40.89 | | | 38.05 | | | -2.84 | | | | | -6.95 |
| pre-post sd | | 5 | 23 | | 3.65 | 22.7 | | 1.21 | -0.30 | 2.61 | | | | -1.30 |
| pre-post sd | | 5 | 1036.9 | | 523.50 | 1036.9 | | 523.50 | 0.00 | 234.12 | | | | 0.00 |
| pre-post sd | | 5 | 1.15 | | 0.12 | 1.08 | | 0.15 | -0.07 | 0.07 | | | | -6.09 |
| pre-post sd | | 5 | 70.5 | | 10.12 | 69.3 | | 9.27 | -1.20 | 4.41 | | | | -1.70 |
| pre-post sd | | 5 | 42 | | 6.73 | 45.1 | | 4.96 | 3.10 | 3.13 | | | | 7.38 |
| | | 5 | 40.89 | | | 38.05 | | | -2.84 | | | | | -6.95 |
| pre-post sd | | 5 | 23 | | 3.65 | 22.7 | | 1.21 | -0.30 | 2.61 | | | | -1.30 |
| pre-post sd | | 5 | 1036.9 | | 523.50 | 1036.9 | | 523.50 | 0.00 | 234.12 | | | | 0.00 |
| | | 45 | 1.02 | | 0.12 | | | | | | | | | |
| | change score sd (imputed) | 45 | 0.86 | | 0.11 | | | | | | | | | 0.60 |
| | | 45 | 0.91 | | 0.11 | | | | | | | | | |
| | | 45 | 1.19 | | 0.11 | | | | | | | | | |
| | | 45 | 1.03 | | 0.10 | | | | | | | | | |
| | | 45 | 1.05 | | 0.09 | | | | | | | | | |
| | | 45 | 0.59 | | 0.07 | | | | | | | | | |
| | change score sd (imputed) | 45 | 0.60 | | 0.07 | | | | | | | | | -0.70 |
| pre-post sd | | 45 | 62 | | 7.00 | 62 | | 7.00 | 0.00 | 3.13 | | | | 0.00 |
| pre-post sd | | 45 | 22.9 | | 2.30 | 22.9 | | 2.30 | 0.00 | 1.03 | | | | 0.00 |
| pre-post sd | | 45 | 30.4 | | 4.30 | 30.4 | | 4.30 | 0.00 | 1.92 | | | | 0.00 |
| | | 45 | 43.15 | | | 43.15 | | | 0.00 | | | | | 0.00 |
| change score sd (imputed) | | 45 | 37.6 | | 3.30 | 37.6 | | 3.30 | 0.00 | 1.48 | | | | 0.00 |
| pre-post sd | | 45 | 1102 | | 264.00 | 1102 | | 264.00 | 0.00 | 118.06 | | | | 0.00 |
| other | | 45 | 56.3 | | 8.70 | | | | | | | | | |
| other | | 45 | 39.2 | | 7.00 | | | | | | | | | |
| other | | 45 | 137.5 | | 26.50 | | | | | | | | | |
| other | | 45 | 17.2 | | 3.80 | | | | | | | | | |
| other | | 45 | 437 | | 38.00 | | | | | | | | | |
| other | | 45 | 407 | | 36.00 | | | | | | | | | |
| other | | 45 | 6.6 | | 0.60 | | | | | | | | | |
| | | 27 | 0.92 | | 0.16 | | | | | | | | | |
| | | 27 | 0.82 | | 0.12 | | | | | | | | | |
| | | 27 | 0.60 | | 0.10 | | | | | | | | | |
| | | 27 | 0.36 | | 0.06 | | | | | | | | | |
| | | 27 | 65 | | 8.00 | | | | | | | | | |
| | | 27 | 25.1 | | 2.90 | | | | | | | | | |
| | | 27 | 31.4 | | 5.40 | | | | | | | | | |
| | | 27 | 44.59 | | | | | | | | | | | |
| pre-post sd | | 27 | 925 | | 236.00 | 925 | | 236.00 | 0.00 | 105.54 | | | | 0.00 |

Outcome Characteristics

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 34 | 57.8 | | | | | | | | | | | |
| | | 34 | 42.8 | | | | | | | | | | | |
| | | 34 | 126 | | | | | | | | | | | |
| | | 34 | 17.4 | | | | | | | | | | | |
| | | 34 | 1.74 | | | | | | | | | | | |
| | | 27 | 0.92 | | 0.16 | | | | | | | | | |
| | | 27 | 0.82 | | 0.12 | | | | | | | | | |
| | | 27 | 0.60 | | 0.10 | | | | | | | | | |
| | | 27 | 0.36 | | 0.06 | | | | | | | | | |
| | | 27 | 65 | | 8.00 | | | | | | | | | |
| | | 27 | 25.1 | | 2.90 | | | | | | | | | |
| | | 27 | 31.4 | | 5.40 | | | | | | | | | |
| pre-post sd | | 27 | 925 | | 236.00 | 925 | | 236.00 | 0.00 | 105.54 | | | | 0.00 |
| | | 34 | 57.8 | | | | | | | | | | | |
| | | 34 | 42.8 | | | | | | | | | | | |
| | | 34 | 126 | | | | | | | | | | | |
| | | 34 | 17.4 | | | | | | | | | | | |
| | | 34 | 1.74 | | | | | | | | | | | |
| | change score sd (imputed) | 29 | 0.85 | | 0.12 | | | | -0.85 | | | | | -0.30 |
| | | 29 | 0.68 | | 0.10 | | | | | | | | | |
| | | 29 | 1.01 | | 0.14 | | | | | | | | | |
| | change score sd (imputed) | 29 | 0.96 | | 0.15 | | | | -0.96 | | | | | 0.75 |
| change score sd (imputed) | | 29 | | | 0.00 | | | | -0.34 | 1.45 | | | | |
| change score sd (imputed) | | 29 | 23.89 | | 3.08 | 24 | | 3.20 | 0.08 | 0.56 | | | | 0.33 |
| change score sd (imputed) | | 29 | | | | | | | 1.47 | 2.03 | | | | |
| change score sd (imputed) | | 29 | | | | | | | 1.52 | 3.51 | | | | |
| change score sd (imputed) | | 29 | | | | | | | 1.41 | 5.21 | | | | |
| change score sd (imputed) | | 29 | | | | | | | 25.80 | 50.00 | | | | |
| change score sd (imputed) | | 29 | | | | | | | 28.20 | 50.50 | | | | |
| pre-post sd | | 29 | 45.4 | | 5.70 | 46 | | 6.20 | 0.60 | 2.71 | | | | 1.32 |
| | change score sd (imputed) | 29 | 0.85 | | 0.12 | | | | -0.85 | | | | | -0.30 |
| | | 29 | 0.68 | | 0.10 | | | | | | | | | |
| | | 29 | 1.01 | | 0.14 | | | | | | | | | |
| | change score sd (imputed) | 29 | 0.96 | | 0.15 | | | | -0.96 | | | | | 0.75 |
| change score sd (imputed) | | 29 | | | | | | | -0.34 | 1.45 | | | | |
| change score sd (imputed) | | 29 | 23.89 | | 3.08 | 24 | | 3.20 | 0.08 | 0.56 | | | | 0.33 |
| change score sd (imputed) | | 29 | | | | | | | 1.47 | 2.03 | | | | |
| change score sd (imputed) | | 29 | | | | | | | 1.52 | 3.51 | | | | |
| change score sd (imputed) | | 29 | | | | | | | 1.41 | 5.21 | | | | |
| change score sd (imputed) | | 29 | | | | | | | 25.80 | 50.00 | | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| change score sd (imputed) | | 29 | | | | | | | 28.20 | 50.50 | | | | |
| pre-post sd | | 29 | 45.4 | | 5.70 | 46 | | 6.20 | 0.60 | 2.71 | | | | 1.32 |
| | change score sd (imputed) | 30 | 0.7 | | 0.10 | | | | -0.70 | | | | | -2.30 |
| | | 30 | 0.59 | | 0.08 | | | | | | | | | |
| | | 30 | 0.85 | | 0.12 | | | | | | | | | |
| | change score sd (imputed) | 30 | 0.75 | | 0.09 | | | | -0.75 | | | | | 0.99 |
| change score sd (imputed) | | 30 | | | 0.00 | | | 0.00 | -0.19 | 1.55 | | | | |
| change score sd (imputed) | | 30 | 24.93 | | 3.02 | 25.2 | | 3.10 | 0.29 | 0.73 | | | | 1.16 |
| change score sd (imputed) | | 30 | | | | | | | 0.51 | 1.45 | | | | |
| change score sd (imputed) | | 30 | | | | | | | 2.26 | 4.17 | | | | |
| change score sd (imputed) | | 30 | | | | | | | 3.07 | 4.78 | | | | |
| change score sd (imputed) | | 30 | | | | | | | 60.60 | 179.60 | | | | |
| change score sd (imputed) | | 30 | | | | | | | 13.50 | 35.30 | | | | |
| pre-post sd | | 30 | 34.7 | | 3.50 | 35 | | 3.40 | 0.30 | 1.55 | | | | 0.86 |
| | change score sd (imputed) | 30 | 0.7 | | 0.10 | | | | -0.70 | | | | | -2.30 |
| | | 30 | 0.59 | | 0.08 | | | | | | | | | |
| | | 30 | 0.85 | | 0.12 | | | | | | | | | |
| | change score sd (imputed) | 30 | 0.75 | | 0.09 | | | | -0.75 | | | | | 0.99 |
| change score sd (imputed) | | 30 | | | | | | | -0.41 | 1.56 | | | | |
| change score sd (imputed) | | 30 | 24.93 | | 3.02 | 25.2 | | 3.10 | 0.29 | 0.73 | | | | 1.16 |
| change score sd (imputed) | | 30 | | | | | | | 0.51 | 1.45 | | | | |
| change score sd (imputed) | | 30 | | | | | | | 2.26 | 4.17 | | | | |
| change score sd (imputed) | | 30 | | | | | | | 3.07 | 4.78 | | | | |
| change score sd (imputed) | | 30 | | | | | | | 60.60 | 179.60 | | | | |
| change score sd (imputed) | | 30 | | | | | | | 13.50 | 35.30 | | | | |
| pre-post sd | | 30 | 34.7 | | 3.50 | 35 | | 3.40 | 0.30 | 1.55 | | | | 0.86 |
| | | 20 | 45.8 | | 4.00 | | | | | | | | | |
| | | 20 | 19.9 | | 2.10 | | | | | | | | | |
| pre-post sd | change score sd (imputed) | 20 | 0.611 | | 0.05 | 0.616 | | 0.04 | 0.01 | 0.02 | | | | 0.96 |
| pre-post sd | | 9 | 0.78 | | 0.09 | 0.74 | | 0.13 | -0.04 | 0.06 | | | | -5.13 |
| pre-post sd | | 9 | 1.15 | | 0.29 | 1.14 | | 0.32 | -0.01 | 0.14 | | | | -0.87 |
| pre-post sd | | 9 | 2.24 | | 0.49 | 2.31 | | 0.34 | 0.07 | 0.24 | | | | 3.12 |
| pre-post sd | | 9 | 26.4 | | 2.66 | 28.15 | | 3.89 | 1.75 | 1.89 | | | | 6.63 |
| pre-post sd | | 9 | 84.2 | | 17.70 | 84.8 | | 16.70 | 0.60 | 7.75 | | | | 0.71 |
| | | 123 | 69.5 | | 12.00 | | | | | | | | | |
| | | 123 | 37.4 | | 5.60 | | | | | | | | | |
| | | 123 | 816 | | 356.00 | | | | | | | | | |
| | | 123 | 22.9 | | 4.20 | | | | | | | | | |
| change score sd (imputed) | confidence interval | 112 | 0.927 | | 0.15 | 0.93 | | 0.15 | 0.00 | 0.03 | | | | 0.33 |
| change score sd (imputed) | confidence interval | 112 | 0.703 | | 0.11 | 0.696 | | 0.11 | -0.01 | 0.02 | | | | -1.05 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pre-post sd | | 112 | 0.41 | | 0.74 | 1.66 | | 1.79 | 1.25 | 1.17 | | | | 304.88 |
| | | 28 | 69.4 | | 11.40 | | | | | | | | | |
| | | 28 | 0.98 | | 0.10 | | | | | | | | | |
| | | 28 | 38.1 | | 7.70 | | | | | | | | | |
| | | 28 | 41.5 | | 5.70 | | | | | | | | | |
| | change score sd (imputed) | 23 | 0.64 | | 0.11 | | | | -0.64 | | | | | -0.60 |
| | change score sd (imputed) | 23 | 0.99 | | 0.15 | | | | -0.99 | | | | | -0.10 |
| | change score sd (imputed) | 23 | 0.72 | | 0.10 | | | | -0.72 | | | | | -0.40 |
| | change score sd (imputed) | 23 | 0.56 | | 0.12 | | | | -0.56 | | | | | 0.80 |
| | change score sd (imputed) | 25 | 0.37 | | 0.05 | | | | -0.37 | | | | | -1.40 |
| | change score sd (imputed) | 25 | 0.5 | | 0.06 | | | | -0.50 | | | | | -0.70 |
| | change score sd (imputed) | 25 | 0.59 | | 0.07 | | | | -0.59 | | | | | -0.20 |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| | | 28 | 70.8 | | 10.00 | | | | | | | | | |
| | | 28 | 1 | | 0.12 | | | | | | | | | |
| | | 28 | 40.4 | | 7.10 | | | | | | | | | |
| | | 28 | 40.5 | | 4.00 | | | | | | | | | |
| | change score sd (imputed) | 19 | 0.65 | | 0.10 | | | | -0.65 | | | | | 1.20 |
| | change score sd (imputed) | 19 | 1.02 | | 0.15 | | | | -1.02 | | | | | 0.50 |
| | change score sd (imputed) | 19 | 0.75 | | 0.11 | | | | -0.75 | | | | | -1.00 |
| | change score sd (imputed) | 19 | 0.6 | | 0.15 | | | | -0.60 | | | | | 0.90 |
| | change score sd (imputed) | 21 | 0.36 | | 0.06 | | | | -0.36 | | | | | -0.30 |
| | change score sd (imputed) | 21 | 0.52 | | 0.07 | | | | -0.52 | | | | | -1.00 |
| | change score sd (imputed) | 21 | 0.61 | | 0.08 | | | | -0.61 | | | | | -0.60 |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| pre-post sd | change score sd (imputed) | | | | | | | | | | | | | |
| | | 42 | 69.3 | | 14.60 | | | | | | | | | |
| | | 42 | 41 | | 8.00 | | | | | | | | | |
| | | 42 | 39 | | 4.90 | | | | | | | | | |
| | change score sd (imputed) | 36 | 0.94 | | 0.16 | | | | -0.94 | | | | | -0.01 |
| | change score sd (imputed) | 36 | 0.89 | | 0.15 | | | | -0.89 | | | | | -0.57 |
| | change score sd (imputed) | 36 | 0.7 | | 0.10 | | | | -0.70 | | | | | -0.01 |
| | change score sd (imputed) | 36 | 1.05 | | 0.15 | | | | -1.05 | | | | | -1.18 |
| | change score sd (imputed) | 36 | 0.76 | | 0.11 | | | | -0.76 | | | | | -0.11 |
| | change score sd (imputed) | 36 | 0.36 | | 0.06 | | | | -0.36 | | | | | -0.55 |
| | change score sd (imputed) | 36 | 0.53 | | 0.07 | | | | -0.53 | | | | | -0.47 |
| | change score sd (imputed) | 36 | 0.61 | | 0.08 | | | | -0.61 | | | | | 0.05 |
| | change score sd (imputed) | 36 | | | 0.00 | | | | 0.00 | | | | | -0.71 |
| | | 42 | 69.3 | | 14.60 | | | | | | | | | |
| | | 42 | 41 | | 8.00 | | | | | | | | | |
| | | 42 | 39 | | 4.90 | | | | | | | | | |
| | change score sd (imputed) | 36 | 0.94 | | 0.16 | | | | -0.94 | | | | | -0.01 |
| | change score sd (imputed) | 36 | 0.89 | | 0.15 | | | | -0.89 | | | | | -0.57 |
| | change score sd (imputed) | 36 | 0.7 | | 0.10 | | | | -0.70 | | | | | -0.01 |
| | change score sd (imputed) | 36 | 1.05 | | 0.15 | | | | -1.05 | | | | | -1.18 |
| | change score sd (imputed) | 36 | 0.76 | | 0.11 | | | | -0.76 | | | | | -0.11 |
| | change score sd (imputed) | 36 | 0.36 | | 0.06 | | | | -0.36 | | | | | -0.55 |
| | change score sd (imputed) | 36 | 0.53 | | 0.07 | | | | -0.53 | | | | | -0.47 |
| | change score sd (imputed) | 36 | 0.61 | | 0.08 | | | | -0.61 | | | | | 0.05 |
| | | 36 | | | 0.00 | | | | 0.00 | | | | | -0.71 |
| | | 45 | 84.1 | | 9.80 | | | | | | | | | |
| | | 45 | 27.7 | | 3.30 | | | | | | | | | |
| | | 45 | 1039 | | 455.00 | | | | | | | | | |
| | | 45 | 1.4 | | 3.00 | | | | | | | | | |
| pre-post sd | change score sd (imputed) | 43 | 1.206 | | 0.15 | 1.221 | | 0.15 | 0.02 | 0.07 | | | | 1.18 |
| pre-post sd | change score sd (imputed) | 43 | 0.919 | | 0.08 | 0.908 | | 0.07 | -0.01 | 0.03 | | | | -0.87 |
| pre-post sd | change score sd (imputed) | 43 | 1.004 | | 0.09 | 1.004 | | 0.08 | 0.00 | 0.04 | | | | 0.23 |
| | | 44 | 81.9 | | 10.70 | | | | | | | | | |
| | | 44 | 26.7 | | 2.90 | | | | | | | | | |
| | | 44 | 996 | | 293.00 | | | | | | | | | |
| | | 44 | 0.7 | | 1.00 | | | | | | | | | |
| pre-post sd | change score sd (imputed) | 42 | 1.238 | | 0.17 | 1.235 | | 0.17 | 0.00 | 0.08 | | | | -0.08 |
| pre-post sd | change score sd (imputed) | 42 | 0.933 | | 0.08 | 0.923 | | 0.08 | -0.01 | 0.04 | | | | -0.68 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pre-post sd | change score sd (imputed) | 42 | 1.01 | | 0.12 | 1.007 | | 0.11 | 0.00 | 0.05 | | | | 0.15 |
| | | 20 | 58.2 | | 6.70 | | | | | | | | | |
| | | 20 | 23 | | 3.80 | | | | | | | | | |
| | | 20 | 33.3 | | 11.70 | | | | | | | | | |
| | confidence interval | 20 | 0.521 | 0.02 | 0.09 | | | | -0.52 | | | | | 0.30 |
| | confidence interval | 20 | 0.471 | 0.12 | 0.54 | | | | -0.47 | | | | | -0.30 |
| | confidence interval | 20 | 1.1 | 0.02 | 0.09 | | | | -1.10 | | | | | 0.20 |
| | confidence interval | 20 | 0.953 | 0.01 | 0.04 | | | | -0.95 | | | | | -0.10 |
| | confidence interval | 20 | 0.852 | 0.01 | 0.04 | | | | -0.85 | | | | | -0.90 |
| | confidence interval | 20 | 0.696 | 0.01 | 0.04 | | | | -0.70 | | | | | 0.80 |
| | confidence interval | 20 | 0.838 | 0.01 | 0.04 | | | | -0.84 | | | | | -0.70 |
| | confidence interval | 20 | 0.986 | 0.02 | 0.09 | | | | -0.99 | | | | | 1.40 |
| | confidence interval | 20 | 32 | 0.8 | 3.58 | | | | -32.00 | | | | | 1.30 |
| | confidence interval | 20 | 39.4 | 0.7 | 3.13 | | | | -39.40 | | | | | -0.20 |
| | confidence interval | 20 | 913 | 136 | 608.21 | | | | -913.00 | | | | | -3.10 |
| | confidence interval | 20 | 88 | 4.3 | 19.23 | | | | -88.00 | | | | | 17.00 |
| | | 20 | 58.2 | | 6.70 | | | | | | | | | |
| | | 20 | 23 | | 3.80 | | | | | | | | | |
| | | 20 | 33.3 | | 11.70 | | | | | | | | | |
| | confidence interval | 20 | 0.521 | 0.02 | 0.09 | | | | -0.52 | | | | | 0.30 |
| | confidence interval | 20 | 0.471 | 0.12 | 0.54 | | | | -0.47 | | | | | -0.30 |
| | confidence interval | 20 | 1.1 | 0.02 | 0.09 | | | | -1.10 | | | | | 0.20 |
| | confidence interval | 20 | 0.953 | 0.01 | 0.04 | | | | -0.95 | | | | | -0.10 |
| | confidence interval | 20 | 0.852 | 0.01 | 0.04 | | | | -0.85 | | | | | -0.90 |
| | confidence interval | 20 | 0.696 | 0.01 | 0.04 | | | | -0.70 | | | | | 0.80 |
| | confidence interval | 20 | 0.838 | 0.01 | 0.04 | | | | -0.84 | | | | | -0.70 |
| | confidence interval | 20 | 0.986 | 0.02 | 0.09 | | | | -0.99 | | | | | 1.40 |
| | confidence interval | 20 | 32 | 0.8 | 3.58 | | | | -32.00 | | | | | 1.30 |
| | confidence interval | 20 | 39.4 | 0.7 | 3.13 | | | | -39.40 | | | | | -0.20 |
| | confidence interval | 20 | 913 | 136 | 608.21 | | | | -913.00 | | | | | -3.10 |
| | confidence interval | 20 | 88 | 4.3 | 19.23 | | | | -88.00 | | | | | 17.00 |
| change score sd (imputed) | | 32 | 65.2 | | 12.60 | 64.2 | | | -1.00 | 2.00 | | | | -1.53 |
| change score sd (imputed) | | 32 | 39.7 | | 5.40 | 40 | | | 0.30 | 1.00 | | | | 0.76 |
| change score sd (imputed) | | 32 | 24.5 | | 8.40 | 24.1 | | | -0.40 | 1.40 | | | | -1.63 |
| confidence interval | | 31 | 0.69 | | 0.12 | 0.693 | | | 0.00 | 0.02 | | -0 | 0.01 | 0.43 |
| confidence interval | | 31 | 0.59 | | 0.10 | 0.589 | | | 0.00 | 0.02 | | -0.01 | 0.006 | -0.17 |
| confidence interval | | 31 | 0.52 | | 0.09 | 0.522 | | | 0.00 | 0.04 | | -0.01 | 0.015 | 0.38 |
| confidence interval | | 30 | 219.93 | | 47.18 | 217.15 | | | -2.78 | 6.40 | | -5.17 | -0.39 | -1.26 |
| confidence interval | | 30 | 205.46 | | 40.74 | 203.62 | | | -1.84 | 6.48 | | -4.26 | 0.58 | -0.90 |
| confidence interval | | 30 | 1067.2 | | 42.39 | 1062.25 | | | -4.99 | 15.02 | | -10.6 | 0.62 | -0.47 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| confidence interval | | 30 | 1361.4 | | 310.47 | 1339.45 | | | -21.95 | 58.52 | | -43.8 | -0.1 | -1.61 |
| confidence interval | | 28 | 161.79 | | 29.15 | 161.55 | | | -0.24 | 3.52 | | -1.6 | 1.13 | -0.15 |
| confidence interval | | 28 | 586.41 | | 147.56 | 589.22 | | | 2.81 | 17.86 | | -4.11 | 9.74 | 0.48 |
| confidence interval | | 28 | 287.14 | | 72.66 | 284.21 | | | -2.93 | 12.40 | | -7.74 | 1.88 | -1.02 |
| confidence interval | | 23 | 55.66 | | 13.47 | 54.99 | | | -0.67 | 3.65 | | -2.25 | 0.91 | -1.20 |
| confidence interval | | 23 | 50.62 | | 10.43 | 50.16 | | | -0.46 | 2.97 | | -1.74 | 0.83 | -0.91 |
| confidence interval | | 23 | 1092.1 | | 0.00 | 1088.56 | | | -3.54 | 28.76 | | -16 | 8.89 | -0.32 |
| confidence interval | | 23 | | | 0.00 | | | | -1.00 | 14.13 | | -7.11 | 5.11 | |
| confidence interval | | 28 | 51.56 | | 15.69 | 53.41 | | | 1.85 | 9.34 | | -1.77 | 5.47 | 3.59 |
| confidence interval | | 28 | 112.13 | | 39.98 | 119.31 | | | 7.18 | 33.01 | | -5.62 | 19.98 | 6.40 |
| confidence interval | | 28 | 481.82 | | 108.02 | 473.07 | | | -8.75 | 86.81 | | -42.4 | 24.91 | -1.82 |
| change score sd (imputed) | | 32 | 65.2 | | 12.60 | 64.2 | | | -1.00 | 2.00 | | | | -1.53 |
| change score sd (imputed) | | 32 | 39.7 | | 5.40 | 40 | | | 0.30 | 1.00 | | | | 0.76 |
| change score sd (imputed) | | 32 | 24.5 | | 8.40 | 24.1 | | | -0.40 | 1.40 | | | | -1.63 |
| confidence interval | | 31 | 0.69 | | 0.12 | 0.693 | | | 0.00 | 0.02 | | -0 | 0.01 | 0.43 |
| confidence interval | | 31 | 0.59 | | 0.10 | 0.589 | | | 0.00 | 0.02 | | -0.01 | 0.006 | -0.17 |
| confidence interval | | 31 | 0.52 | | 0.09 | 0.522 | | | 0.00 | 0.04 | | -0.01 | 0.015 | 0.38 |
| confidence interval | | 30 | 219.93 | | 47.18 | 217.15 | | | -2.78 | 6.40 | | -5.17 | -0.39 | -1.26 |
| confidence interval | | 30 | 205.46 | | 40.74 | 203.62 | | | -1.84 | 6.48 | | -4.26 | 0.58 | -0.90 |
| confidence interval | | 30 | 1067.2 | | 42.39 | 1062.25 | | | -4.99 | 15.02 | | -10.6 | 0.62 | -0.47 |
| confidence interval | | 30 | 1361.4 | | 310.47 | 1339.45 | | | -21.95 | 58.52 | | -43.8 | -0.1 | -1.61 |
| confidence interval | | 28 | 161.79 | | 29.15 | 161.55 | | | -0.24 | 3.52 | | -1.6 | 1.13 | -0.15 |
| confidence interval | | 28 | 586.41 | | 147.56 | 589.22 | | | 2.81 | 17.86 | | -4.11 | 9.74 | 0.48 |
| confidence interval | | 28 | 287.14 | | 72.66 | 284.21 | | | -2.93 | 12.40 | | -7.74 | 1.88 | -1.02 |
| confidence interval | | 23 | 55.66 | | 13.47 | 54.99 | | | -0.67 | 3.65 | | -2.25 | 0.91 | -1.20 |
| confidence interval | | 23 | 50.62 | | 10.43 | 50.16 | | | -0.46 | 2.97 | | -1.74 | 0.83 | -0.91 |
| confidence interval | | 23 | 1092.1 | | 0.00 | 1088.56 | | | -3.54 | 28.76 | | -16 | 8.89 | -0.32 |
| confidence interval | | 23 | | | 0.00 | | | | -1.00 | 14.13 | | -7.11 | 5.11 | |
| confidence interval | | 28 | 51.56 | | 15.69 | 53.41 | | | 1.85 | 9.34 | | -1.77 | 5.47 | 3.59 |
| confidence interval | | 28 | 112.13 | | 39.98 | 119.31 | | | 7.18 | 33.01 | | -5.62 | 19.98 | 6.40 |
| confidence interval | | 28 | 481.82 | | 108.02 | 473.07 | | | -8.75 | 86.81 | | -42.4 | 24.91 | -1.82 |
| pre-post sd | | 34 | 1.15 | | 0.07 | 1.14 | | 0.07 | -0.01 | 0.03 | | | | -0.96 |
| pre-post sd | | 34 | 1.23 | | 0.11 | 1.22 | | 0.11 | -0.01 | 0.05 | | | | -0.49 |
| pre-post sd | | 34 | 0.96 | | 0.13 | 0.93 | | 0.13 | -0.02 | 0.06 | | | | -2.30 |
| pre-post sd | | 34 | 0.77 | | 0.10 | 0.76 | | 0.11 | 0.00 | 0.05 | | | | -0.39 |
| pre-post sd | | 34 | 0.90 | | 0.16 | 0.89 | | 0.17 | -0.01 | 0.07 | | | | -0.89 |
| pre-post sd | | 34 | 0.71 | | 0.06 | 0.72 | | 0.06 | 0.01 | 0.03 | | | | 1.27 |
| | | 34 | 62.9 | | 10.20 | | | | | | | | | |
| | | 34 | 22.88 | | | | | | | | | | | |
| | | 34 | 32.2 | | 7.00 | | | | | | | | | |

Outcome Characteristics

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 34 | 42.65 | | | | | | | | | | | |
| | | 24 | 636.9 | | 280.90 | | | | | | | | | |
| | | 24 | 2 | | 1.90 | | | | | | | | | |
| pre-post sd | | 24 | 28.1 | | 3.50 | 27.3 | | 2.00 | -0.80 | 1.91 | | | | -2.85 |
| pre-post sd | | 24 | 39.4 | | 5.00 | 38.2 | | 3.20 | -1.20 | 2.54 | | | | -3.05 |
| pre-post sd | | 24 | 38.4 | | 4.60 | 37.8 | | 3.70 | -0.60 | 2.05 | | | | -1.56 |
| pre-post sd | | 24 | 6 | | 0.80 | 6.3 | | 1.20 | 0.30 | 0.59 | | | | 5.00 |
| pre-post sd | | 24 | 26.9 | | 16.20 | 22.3 | | 13.60 | -4.60 | 7.13 | | | | -17.10 |
| pre-post sd | | 24 | 81.3 | | 18.60 | 79.1 | | 19.30 | -2.20 | 8.50 | | | | -2.71 |
| pre-post sd | | 24 | 50.6 | | 15.00 | 49.9 | | 11.10 | -0.70 | 6.96 | | | | -1.38 |
| pre-post sd | | 24 | 134.4 | | 27.30 | 129.6 | | 28.60 | -4.80 | 12.56 | | | | -3.57 |
| pre-post sd | | 24 | 68.6 | | 20.00 | 66.6 | | 20.20 | -2.00 | 8.99 | | | | -2.92 |
| pre-post sd | | 24 | 0.678 | | 0.06 | 0.676 | | 0.07 | 0.00 | 0.03 | | | | -0.29 |
| pre-post sd | | 24 | 0.628 | | 0.04 | 0.621 | | 0.05 | -0.01 | 0.02 | | | | -1.11 |
| pre-post sd | | 24 | 0.99 | | 0.09 | 0.98 | | 0.11 | -0.01 | 0.05 | | | | -1.01 |
| pre-post sd | | 24 | 0.831 | | 0.07 | 0.824 | | 0.08 | -0.01 | 0.04 | | | | -0.84 |
| | | 24 | 636.9 | | 280.90 | | | | | | | | | |
| | | 24 | 2 | | 1.90 | | | | | | | | | |
| pre-post sd | | 24 | 28.1 | | 3.50 | 27.3 | | 2.00 | -0.80 | 1.91 | | | | -2.85 |
| pre-post sd | | 24 | 39.4 | | 5.00 | 38.2 | | 3.20 | -1.20 | 2.54 | | | | -3.05 |
| pre-post sd | | 24 | 38.4 | | 4.60 | 37.8 | | 3.70 | -0.60 | 2.05 | | | | -1.56 |
| pre-post sd | | 24 | 6 | | 0.80 | 6.3 | | 1.20 | 0.30 | 0.59 | | | | 5.00 |
| pre-post sd | | 24 | 26.9 | | 16.20 | 22.3 | | 13.60 | -4.60 | 7.13 | | | | -17.10 |
| pre-post sd | | 24 | 81.3 | | 18.60 | 79.1 | | 19.30 | -2.20 | 8.50 | | | | -2.71 |
| pre-post sd | | 24 | 50.6 | | 15.00 | 49.9 | | 11.10 | -0.70 | 6.96 | | | | -1.38 |
| pre-post sd | | 24 | 134.4 | | 27.30 | 129.6 | | 28.60 | -4.80 | 12.56 | | | | -3.57 |
| pre-post sd | | 24 | 68.6 | | 20.00 | 66.6 | | 20.20 | -2.00 | 8.99 | | | | -2.92 |
| pre-post sd | | 24 | 0.678 | | 0.06 | 0.676 | | 0.07 | 0.00 | 0.03 | | | | -0.29 |
| pre-post sd | | 24 | 0.628 | | 0.04 | 0.621 | | 0.05 | -0.01 | 0.02 | | | | -1.11 |
| pre-post sd | | 24 | 0.99 | | 0.09 | 0.98 | | 0.11 | -0.01 | 0.05 | | | | -1.01 |
| pre-post sd | | 24 | 0.831 | | 0.07 | 0.824 | | 0.08 | -0.01 | 0.04 | | | | -0.84 |
| | | 30 | 625.7 | | 265.60 | | | | | | | | | |
| | | 30 | 1.9 | | 2.00 | | | | | | | | | |
| pre-post sd | | 30 | 28.2 | | 3.70 | 27.7 | | 2.50 | -0.50 | 1.81 | | | | -1.77 |
| pre-post sd | | 30 | 37.7 | | 4.40 | 37.9 | | 3.10 | 0.20 | 2.10 | | | | 0.53 |
| pre-post sd | | 30 | 40.6 | | 5.30 | 40.6 | | 4.00 | 0.00 | 2.44 | | | | 0.00 |
| pre-post sd | | 30 | 515 | | 68.40 | 535.5 | | 67.30 | 20.50 | 30.36 | | | | 3.98 |
| pre-post sd | | 30 | 24.8 | | 3.90 | 25.4 | | 1.30 | 0.60 | 2.79 | | | | 2.42 |
| pre-post sd | | 30 | 6.3 | | 1.20 | 5.9 | | 0.90 | -0.40 | 0.55 | | | | -6.35 |
| pre-post sd | | 30 | 33.5 | | 14.60 | 31.2 | | 12.30 | -2.30 | 6.42 | | | | -6.87 |

Outcome Characteristics

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pre-post sd | | 30 | 15.5 | | 3.60 | 17.7 | | 5.00 | 2.20 | 2.36 | | | | 14.19 |
| pre-post sd | | 30 | 81.1 | | 26.00 | 92 | | 19.40 | 10.90 | 12.02 | | | | 13.44 |
| pre-post sd | | 30 | 80.3 | | 19.50 | 84.6 | | 19.70 | 4.30 | 8.77 | | | | 5.35 |
| pre-post sd | | 30 | 50.2 | | 16.10 | 53 | | 9.50 | 2.80 | 8.61 | | | | 5.58 |
| pre-post sd | | 30 | 51.5 | | 14.90 | 51.1 | | 10.70 | -0.40 | 7.04 | | | | -0.78 |
| pre-post sd | | 30 | 142.7 | | 42.70 | 140.7 | | 33.80 | -2.00 | 19.18 | | | | -1.40 |
| pre-post sd | | 30 | 134.1 | | 31.90 | 132.9 | | 31.90 | -1.20 | 14.27 | | | | -0.89 |
| pre-post sd | | 30 | 69.9 | | 21.90 | 77.8 | | 25.80 | 7.90 | 11.32 | | | | 11.30 |
| pre-post sd | | 30 | 71.7 | | 20.60 | 73.9 | | 19.30 | 2.20 | 9.01 | | | | 3.07 |
| pre-post sd | | 30 | 0.678 | | 0.06 | 0.671 | | 0.05 | -0.01 | 0.03 | | | | -1.03 |
| pre-post sd | | 30 | 0.625 | | 0.05 | 0.628 | | 0.03 | 0.00 | 0.02 | | | | 0.48 |
| pre-post sd | | 30 | 0.981 | | 0.11 | 0.977 | | 0.08 | 0.00 | 0.05 | | | | -0.41 |
| pre-post sd | | 30 | 0.822 | | 0.07 | 0.823 | | 0.06 | 0.00 | 0.03 | | | | 0.12 |
| pre-post sd | | 30 | 0.868 | | 0.08 | 0.863 | | 0.07 | -0.01 | 0.04 | | | | -0.58 |
| pre-post sd | change score sd (imputed) | 19 | 1.11 | | 0.18 | 1.10 | | 0.16 | -0.01 | 0.08 | | | | -0.61 |
| pre-post sd | | 19 | 72.9 | | 15.50 | 74.6 | | 18.00 | 1.70 | 7.88 | | | | 2.33 |
| pre-post sd | | 19 | 27.74 | | | 28.39 | | | 0.65 | | | | | 2.34 |
| pre-post sd | | 19 | 23.1 | | 4.40 | 21.2 | | 4.40 | -1.90 | 1.97 | | | | -8.23 |
| pre-post sd | change score sd (imputed) | 19 | 1.11 | | 0.18 | 1.10 | | 0.16 | -0.01 | 0.08 | | | | -0.61 |
| pre-post sd | | 19 | 72.9 | | 15.50 | 74.6 | | 18.00 | 1.70 | 7.88 | | | | 2.33 |
| pre-post sd | | 19 | 27.74 | | | 28.39 | | | 0.65 | | | | | 2.34 |
| pre-post sd | | 19 | 23.1 | | 4.40 | 21.2 | | 4.40 | -1.90 | 1.97 | | | | -8.23 |
| change score sd (imputed) | change score sd (imputed) | 19 | 0.83 | | 0.11 | 0.81 | | | -0.02 | 0.04 | | | | -2.50 |
| change score sd (imputed) | change score sd (imputed) | 19 | 0.99 | | 0.15 | 0.97 | | | -0.02 | 0.04 | | | | -1.80 |
| | | 19 | 62.2 | | 8.90 | | | | | | | | | |
| | | 19 | 23.1 | | 2.20 | | | | | | | | | |
| pre-post sd | | 19 | 707 | | 278.00 | 908 | | 247.00 | 201.00 | 121.22 | | | | 28.43 |
| pre-post sd | | 19 | 80.5 | | 12.50 | 84.8 | | 11.70 | 4.30 | 5.47 | | | | 3.50 |
| pre-post sd | | 19 | 24.5 | | 8.20 | 25.8 | | 8.50 | 1.30 | 3.75 | | | | 14.00 |
| pre-post sd | | 19 | 19.4 | | 4.60 | 22.2 | | 4.90 | 2.80 | 2.14 | | | | 19.20 |
| pre-post sd | | 19 | 28.2 | | 6.40 | 25.8 | | 8.30 | -2.40 | 3.77 | | | | -8.60 |
| pre-post sd | | 19 | 15.8 | | 3.90 | 15.3 | | 5.60 | -0.50 | 2.69 | | | | -3.20 |
| pre-post sd | | 19 | 24.1 | | 8.10 | 25.8 | | 8.90 | 1.70 | 3.88 | | | | 8.50 |
| pre-post sd | | 19 | 7186 | | 1180.00 | 5393 | | 697.00 | -1793.00 | 630.70 | | | | -24.95 |
| | | 26 | 68.1 | | 10.50 | | | | | | | | | |
| | | 26 | 26.1 | | 3.90 | | | | | | | | | |
| pre-post sd | | 26 | 0.79 | 0.02 | 0.10 | 0.78 | 0.02 | 0.10 | -0.01 | 0.05 | | | | -1.27 |
| pre-post sd | | 26 | 0.92 | 0.02 | 0.10 | 0.92 | 0.02 | 0.10 | 0.00 | 0.05 | | | | 0.00 |
| pre-post sd | | 26 | 1.03 | 0.02 | 0.10 | 1.04 | 0.02 | 0.10 | 0.01 | 0.05 | | | | 0.97 |
| | change score sd (imputed) | 35 | 880.00 | | 116.00 | 878.01 | | | -1.99 | | | | | -0.23 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | change score sd (imputed) | 35 | 841.00 | | 101.00 | 841.50 | | | 0.50 | | | | | 0.06 |
| | change score sd (imputed) | 35 | 667.00 | | 90.00 | 657.99 | | | -9.01 | | | | | -1.35 |
| | change score sd (imputed) | 35 | 634.00 | | 77.00 | 637.17 | | | 3.17 | | | | | 0.50 |
| | change score sd (imputed) | 35 | 982.00 | | 122.00 | 983.67 | | | 1.67 | | | | | 0.17 |
| | change score sd (imputed) | 35 | 701.00 | | 92.00 | 699.74 | | | -1.26 | | | | | -0.18 |
| | change score sd (imputed) | 35 | 653.00 | | 92.00 | 643.07 | | | -9.93 | | | | | -1.52 |
| | change score sd (imputed) | 35 | 636.00 | | 107.00 | 646.49 | | | 10.49 | | | | | -1.65 |
| pre-post sd | | 18 | 61.7 | | 12.90 | 60.7 | | 13.20 | -1.00 | 5.84 | | | | -1.62 |
| pre-post sd | | 18 | 0.78 | | 0.09 | 0.73 | | 0.10 | -0.05 | 0.04 | | | | -6.41 |
| pre-post sd | | 18 | 0.63 | | 0.10 | 0.59 | | 0.12 | -0.04 | 0.05 | | | | -6.35 |
| pre-post sd | | 18 | 0.69 | | 0.12 | 0.67 | | 0.11 | -0.02 | 0.05 | | | | -2.90 |
| pre-post sd | | 18 | 1.01 | | 0.17 | 1.01 | | 0.17 | 0.00 | 0.08 | | | | 0.00 |
| pre-post sd | | 18 | 24.3 | | 4.20 | 24.4 | | 3.80 | 0.10 | 1.83 | | | | 0.41 |
| pre-post sd | | 18 | 13.6 | | 2.20 | 13.8 | | 2.60 | 0.20 | 1.14 | | | | 1.47 |
| pre-post sd | | 18 | 98.6 | | 9.50 | 99.2 | | 8.60 | 0.60 | 4.14 | | | | 0.61 |
| pre-post sd | | 18 | 4.2 | | 1.00 | 4.1 | | 0.90 | -0.10 | 0.44 | | | | -2.38 |
| pre-post sd | | 18 | 23 | | 4.80 | 22 | | 4.40 | -1.00 | 2.09 | | | | -4.35 |
| pre-post sd | | 18 | 28.5 | | 4.20 | 28 | | 4.00 | -0.50 | 1.84 | | | | -1.75 |
| | | 27 | 37.3 | | 4.70 | | | | | | | | | |
| change score sd (imputed) | | 27 | 16.3 | | 3.80 | 15.4 | | | -0.90 | 1.50 | | | | -5.52 |
| change score sd (imputed) | | 27 | 101 | | 16.30 | 100.9 | | | -0.10 | 3.50 | | | | -0.10 |
| change score sd (imputed) | | 27 | 57.3 | | 11.50 | 56.5 | | | -0.80 | 2.50 | | | | -1.40 |
| change score sd (imputed) | | 27 | 43.8 | | 9.90 | 45 | | | 1.20 | 5.10 | | | | 2.74 |
| change score sd (imputed) | | 27 | 0.962 | | 0.13 | 0.955 | | | -0.01 | 0.02 | | | | -0.73 |
| change score sd (imputed) | | 27 | 505 | | 143.00 | 499 | | | -6.00 | 101.00 | | | | -1.19 |
| change score sd (imputed) | | 27 | 11.6 | | 3.30 | 11.6 | | 60.28 | 0.00 | 1.00 | | | | 0.00 |
| change score sd (imputed) | | 27 | 10.7 | | 10.60 | 8.4 | | | -2.30 | 9.40 | | | | -21.50 |
| change score sd (imputed) | | 27 | 1.207 | | 0.18 | 1.208 | | | 0.00 | 0.04 | | | | 0.08 |
| change score sd (imputed) | | 27 | 1.096 | | 0.15 | 1.099 | | | 0.00 | 0.03 | | | | 0.27 |
| | | 47 | 70 | | 14.00 | | | | | | | | | |
| | | 47 | 15 | | 3.00 | | | | | | | | | |
| pre-post sd | | 47 | 0.79 | | 0.17 | 0.75 | | 0.15 | -0.04 | 0.07 | | | | -5.06 |
| pre-post sd | | 47 | 0.59 | | 0.14 | 0.58 | | 0.12 | -0.01 | 0.06 | | | | -1.69 |
| pre-post sd | | 47 | 0.66 | | 0.13 | 0.63 | | 0.11 | -0.03 | 0.06 | | | | -4.55 |
| pre-post sd | | 47 | 1.01 | | 0.24 | 0.97 | | 0.23 | -0.04 | 0.11 | | | | -3.96 |
| pre-post sd | | 47 | 1.08 | | 0.16 | 1.03 | | 0.17 | -0.05 | 0.07 | | | | -4.63 |
| pre-post sd | | 47 | 783 | | 223.00 | 1254 | | 330.00 | 471.00 | 161.76 | | | | 60.15 |
| pre-post sd | | 47 | 130 | | 86.00 | 610 | | 111.00 | 480.00 | 50.34 | | | | 369.23 |
| change score sem | | 76 | 88 | 2 | 17.44 | 85.20 | | | -2.80 | 10.46 | 1.2 | | | -3.18 |
| change score sem | | 76 | 290 | 6.3 | 54.92 | 299.30 | | | 9.30 | 63.64 | 7.3 | | | 3.21 |

Outcome Characteristics

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| change score sem | | 76 | 81.4 | 1.2 | 10.46 | 82.70 | | | 1.30 | 5.23 | 0.6 | | | 1.60 |
| change score sem | | 76 | 34.3 | 0.8 | 6.97 | 34.80 | | | 0.50 | 4.36 | 0.5 | | | 1.46 |
| change score sem | | 76 | 42.3 | 0.6 | 5.23 | 43.20 | | | 0.90 | 1.74 | 0.2 | | | 2.13 |
| pre-post sd | | 76 | 0.87 | 0.01 | 0.09 | 0.87 | 0.01 | 0.09 | 0.00 | 0.04 | | | | 0.00 |
| pre-post sd | | 76 | 1.09 | 0.01 | 0.09 | 1.09 | 0.01 | 0.09 | 0.00 | 0.04 | | | | 0.00 |
| pre-post sd | | 76 | 1.1 | 0.01 | 0.09 | 1.1 | 0.01 | 0.09 | 0.00 | 0.04 | | | | 0.00 |
| pre-post sd | | 76 | 1.3 | 0.02 | 0.17 | 1.29 | 0.02 | 0.17 | -0.01 | 0.08 | | | | -0.77 |
| | | 39 | | | | | | | | | | | | |
| change score sem | | 27 | | | | | | | | | | | | |
| | | 27 | | | | | | | | | | | | |
| | change score sem | 27 | 1.27 | | 0.13 | | | | -1.27 | | | | | 2.22 |
| | change score sem | 27 | 0.7 | | 0.06 | | | | -0.70 | | | | | 0.80 |
| | change score sem | 27 | 1.03 | | 0.13 | | | | -1.03 | | | | | 0.21 |
| | change score sem | 27 | 0.8 | | 0.12 | | | | -0.80 | | | | | 0.69 |
| | change score sem | 27 | 1 | | 0.13 | | | | -1.00 | | | | | -0.80 |
| | | 27 | 64.95 | | 9.79 | | | | | | | | | |
| | | 27 | 1020 | | 479.91 | | | | | | | | | |
| | | 16 | 63.4 | | 13.60 | | | | | | | | | |
| change score sd (imputed) | | 10 | 1.004 | | 0.14 | 0.986 | | 0.14 | -0.02 | 0.04 | | | | -1.89 |
| change score sd (imputed) | | 10 | 0.755 | | 0.06 | 0.745 | | 0.07 | -0.01 | 0.04 | | | | -1.46 |
| pre-post sd | | 33 | 51.4 | | 7.10 | 51 | | 7.30 | -0.40 | 3.23 | | | | -0.78 |
| pre-post sd | | 33 | 20.9 | | 2.20 | 20.8 | | 2.30 | -0.10 | 1.01 | | | | -0.48 |
| pre-post sd | | 33 | 671.5 | | 190.90 | 625.4 | | 190.00 | -46.10 | 85.18 | | | | -6.87 |
| pre-post sd | change score sd (imputed) | 33 | 9.2 | | 5.90 | 7 | | 3.90 | -2.20 | 2.93 | | | | -23.91 |
| pre-post sd | change score sd (imputed) | 33 | 1.002 | | 0.10 | 0.994 | | 0.09 | -0.01 | 0.04 | | | | -0.74 |
| pre-post sd | change score sd (imputed) | 33 | 36.9 | | 3.70 | 37.2 | | 3.90 | 0.30 | 1.71 | | | | 0.77 |
| pre-post sd | change score sd (imputed) | 33 | 15.1 | | 4.50 | 15 | | 4.50 | -0.10 | 2.01 | | | | 0.17 |
| pre-post sd | change score sd (imputed) | 33 | 0.907 | | 0.13 | 0.904 | | 0.13 | 0.00 | 0.06 | | | | -0.27 |
| pre-post sd | change score sd (imputed) | 33 | 0.787 | | 0.13 | 0.781 | | 0.12 | -0.01 | 0.06 | | | | -0.66 |
| pre-post sd | change score sd (imputed) | 33 | 0.676 | | 0.11 | 0.672 | | 0.10 | 0.00 | 0.05 | | | | -0.25 |
| pre-post sd | change score sd (imputed) | 33 | 0.599 | | 0.12 | 0.594 | | 0.12 | -0.01 | 0.05 | | | | -0.69 |
| change score sd (imputed) | | 9 | 89.635 | | 14.70 | 90.99569 | | 12.66 | 1.36 | 5.85 | | | | 1.52 |
| change score sd (imputed) | | 9 | 29 | | 5.10 | 29.5 | | 4.30 | 0.50 | 2.10 | | | | 1.72 |
| change score sd (imputed) | | 9 | 1.2296 | | 0.22 | 1.2396 | | 0.29 | 0.01 | 0.08 | | | | 0.81 |
| change score sd (imputed) | | 9 | 1.0622 | | 0.17 | 1.0722 | | 0.15 | 0.01 | 0.05 | | | | 0.94 |
| change score sd (imputed) | | 9 | 0.9273 | | 0.33 | 1.0148 | | 0.12 | 0.09 | 0.25 | | | | 9.43 |

Outcome Characteristics

| p_sd_c | p_se_c | p_lci_c | p_uci_c | met_sd_c | p_met_sd_c | sd_pooled | te | te_se | te_var | te_lci | te_uci | p_sd_pooled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.76 | | -1.20 | 0.50 | | confidence interval | | | | | | | 1.82 |
| 2.90 | | -1.30 | 1.50 | | confidence interval | | | | | | | 2.99 |
| 2.18 | | -1.70 | 0.40 | | confidence interval | | | | | | | 2.17 |
| 2.90 | | -1.20 | 1.60 | | confidence interval | | | | | | | 2.99 |
| | | | | confidence interval | | 4.16 | 1.40 | 1.41 | 1.99 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 1.76 | | -1.20 | 0.50 | | confidence interval | | | | | | | 1.79 |
| 2.90 | | -1.30 | 1.50 | | confidence interval | | | | | | | 2.93 |
| 2.18 | | -1.70 | 0.40 | | confidence interval | | | | | | | 2.10 |
| 2.90 | | -1.20 | 1.60 | | confidence interval | | | | | | | 2.90 |
| | | | | confidence interval | | 4.48 | 1.50 | 1.61 | 2.60 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 1.76 | | -1.20 | 0.50 | | confidence interval | | | | | | | 1.82 |
| 2.90 | | -1.30 | 1.50 | | confidence interval | | | | | | | 2.95 |
| 2.18 | | -1.70 | 0.40 | | confidence interval | | | | | | | 2.13 |
| 2.90 | | -1.20 | 1.60 | | confidence interval | | | | | | | 2.95 |
| | | | | confidence interval | | 4.23 | 1.50 | 1.43 | 2.06 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | change score sd (imputed) | | 0.02 | 0.00 | 0.00 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.02 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.04 | 0.02 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 2.68 | 0.00 | 0.73 | 0.53 | | | |
| | | | | pre-post sd | | 1.27 | 0.00 | 0.34 | 0.12 | | | |
| | | | | change score sem | | 22.18 | 4.30 | 6.01 | 36.07 | | | |
| | | | | change score sem | | 3.82 | 1.30 | 1.03 | 1.07 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | -0.01 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.02 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 3.36 | 0.00 | 0.78 | 0.60 | | | |
| | | | | pre-post sd | | 1.16 | 0.00 | 0.27 | 0.07 | | | |
| | | | | pre-post sd | | 129.06 | 0.00 | 29.84 | 890.68 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 3.32 | 0.00 | 0.98 | 0.96 | | | |
| | | | | pre-post sd | | 1.02 | 0.00 | 0.30 | 0.09 | | | |

Outcome Characteristics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pre-post sd | | 147.48 | 0.00 | 43.53 | 1894.99 | | | |
| | | | | change score sem | | 5.98 | 4.00 | 1.77 | 3.12 | | | |
| | | | | | | | | | | | | |
| | | | | pre-post sd | | 2.24 | -2.60 | 0.47 | 0.22 | | | |
| | | | | pre-post sd | | 0.04 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.03 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | -0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 2.24 | -2.60 | 0.43 | 0.18 | | | |
| | | | | pre-post sd | | 0.04 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.05 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.00 | 0.01 | 0.00 | | | |
| | | | | | | | | | | | | |
| | | | | change score sem | | 0.04 | 0.02 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.06 | 0.00 | 0.02 | 0.00 | | | |
| | | | | | | | | | | | | |
| 0.63 | 0.20 | | | pre-post sd | change score sem | 0.00 | 0.01 | 0.00 | 0.00 | | | 0.42 |
| 0.35 | 0.11 | | | pre-post sd | change score sem | 0.00 | 0.01 | 0.00 | 0.00 | | | 0.35 |
| | | | | pre-post sd | | 16.61 | 25.00 | 6.78 | 46.00 | | | |
| | | | | pre-post sd | | 11.35 | 16.00 | 4.63 | 21.48 | | | |
| | | | | pre-post sd | | 45.76 | -5.00 | 18.68 | 349.00 | | | |
| | | | | pre-post sd | | 32.44 | -4.00 | 13.24 | 175.40 | | | |
| | | | | pre-post sd | | 34.19 | -5.00 | 13.96 | 194.80 | | | |
| | | | | pre-post sd | | 2.60 | -1.80 | 1.23 | 1.50 | | | |
| | | | | pre-post sd | | 1.79 | -2.20 | 0.84 | 0.71 | | | |
| | | | | change score sd (imputed) | | 1.39 | 4.41 | 0.65 | 0.43 | | | |
| | | | | change score sd (imputed) | | 46.31 | 100.11 | 21.83 | 476.68 | | | |
| | | | | change score sd (imputed) | | 0.45 | 1.93 | 0.21 | 0.04 | | | |
| | | | | change score sd (imputed) | | 4.05 | 17.82 | 1.91 | 3.64 | | | |
| | | | | change score sd (imputed) | | 8.59 | 35.00 | 4.05 | 16.40 | | | |
| | | | | change score sd (imputed) | | 0.01 | -0.01 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.02 | 0.00 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.01 | 0.00 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.01 | 0.02 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 3.31 | -2.60 | 1.52 | 2.31 | | | |
| | | | | pre-post sd | | 2.34 | -1.90 | 1.07 | 1.15 | | | |
| | | | | change score sd (imputed) | | 2.18 | 3.59 | 1.00 | 1.01 | | | |
| | | | | change score sd (imputed) | | 50.29 | 84.67 | 23.11 | 533.86 | | | |

Outcome Characteristics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | change score sd (imputed) | | 0.54 | 1.60 | 0.25 | 0.06 | | | |
| | | | | change score sd (imputed) | | 4.93 | 17.98 | 2.26 | 5.13 | | | |
| | | | | change score sd (imputed) | | 9.67 | 19.78 | 4.44 | 19.75 | | | |
| | | | | change score sd (imputed) | | 0.02 | -0.02 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.02 | -0.01 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.01 | 0.00 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.02 | -0.01 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.02 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.07 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.05 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 1.36 | -1.00 | 0.31 | 0.10 | | | |
| | | | | | | 0.00 | -0.34 | | | | | |
| | | | | pre-post sd | | 109.14 | 16.00 | 24.72 | 611.26 | | | |
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| | | | | | | | | | | | | |
| 3.12 | 0.90 | | | pre-post sd | change score sem | 0.05 | -0.01 | 0.02 | 0.00 | | | 3.14 |
| 2.77 | 0.80 | | | pre-post sd | change score sem | 0.04 | 0.00 | 0.02 | 0.00 | | | 2.54 |
| 2.77 | 0.80 | | | pre-post sd | change score sem | 0.04 | 0.00 | 0.02 | 0.00 | | | 2.81 |
| 3.46 | 1.00 | | | pre-post sd | change score sem | 0.04 | 0.00 | 0.02 | 0.00 | | | 3.47 |
| 2.46 | 0.71 | | | pre-post sd | change score sem | 0.04 | -0.01 | 0.02 | 0.00 | | | 3.13 |
| 1.39 | 0.40 | | | pre-post sd | change score sem | 0.03 | 0.01 | 0.01 | 0.00 | | | 1.33 |
| 31.87 | 9.20 | | | pre-post sd | change score sem | 7.93 | 18.90 | 3.39 | 11.52 | | | 50.43 |
| 10.39 | 3.00 | | | pre-post sd | change score sem | 15.17 | 29.20 | 6.50 | 42.20 | | | 13.11 |
| | | | | pre-post sd | | 4.81 | -0.30 | 1.53 | 2.34 | | | |
| | | | | pre-post sd | | 1.58 | -0.10 | 0.50 | 0.25 | | | |
| | | | | pre-post sd | | 3.59 | -0.80 | 1.14 | 1.30 | | | |
| | | | | pre-post sd | | 1.94 | 0.70 | 0.62 | 0.38 | | | |
| | | | | pre-post sd | | 2.38 | -1.50 | 0.76 | 0.57 | | | |
| | | | | pre-post sd | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.07 | -0.03 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.05 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.02 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.05 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.06 | -0.07 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 3.96 | 0.10 | 1.26 | 1.58 | | | |
| | | | | pre-post sd | | 1.35 | 0.00 | 0.43 | 0.18 | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pre-post sd | | 1.56 | -0.20 | 0.50 | 0.25 | | | |
| | | | | pre-post sd | | 0.04 | 0.00 | 0.01 | 0.00 | | | 3.38 |
| | | | | pre-post sd | | 0.03 | 0.00 | 0.01 | 0.00 | | | 4.51 |
| | | | | pre-post sd | | 0.08 | 0.02 | 0.03 | 0.00 | | | 2.09 |
| | | | | pre-post sd | | 0.04 | 0.00 | 0.01 | 0.00 | | | 4.19 |
| | | | | pre-post sd | | 0.04 | 0.02 | 0.01 | 0.00 | | | 6.28 |
| | | | | pre-post sd | | 0.05 | 0.05 | 0.02 | 0.00 | | | 7.25 |
| | | | | pre-post sd | | 21.13 | 26.60 | 6.69 | 44.76 | | | 19.34 |
| | | | | pre-post sd | | 20.94 | 16.23 | 6.63 | 43.96 | | | 14.34 |
| | | | | pre-post sd | | 0.16 | 0.21 | 0.05 | 0.00 | | | 8.54 |
| | | | | pre-post sd | | 21.17 | 4.47 | 6.70 | 44.94 | | | 244.77 |
| | | | | pre-post sd | | 0.87 | 0.40 | 0.28 | 0.08 | | | 3.38 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 2.50 | | | | | change score sd (imputed) | 0.00 | -0.02 | | | | | 2.66 |
| 5.70 | | | | | change score sd (imputed) | 0.00 | -0.04 | | | | | 4.41 |
| 3.10 | | | | | change score sd (imputed) | 0.00 | -0.03 | | | | | 4.86 |
| 17.00 | | | | change score sd (imputed) | change score sd (imputed) | 5.61 | 4.10 | 1.41 | 2.00 | | | 16.35 |
| 24.40 | | | | change score sd (imputed) | change score sd (imputed) | 6.11 | 3.93 | 1.54 | 2.37 | | | 24.91 |
| 26.50 | | | | change score sd (imputed) | change score sd (imputed) | 4.80 | 2.50 | 1.21 | 1.46 | | | 25.12 |
| 50.90 | | | | change score sd (imputed) | change score sd (imputed) | 12.51 | 7.30 | 3.15 | 9.94 | | | 42.21 |
| 29.50 | | | | change score sd (imputed) | change score sd (imputed) | 12.45 | 3.77 | 3.14 | 9.85 | | | 25.75 |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.01 | 0.00 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.01 | 0.00 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.00 | 0.00 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.01 | 0.00 | 0.00 | 0.00 | | | |
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| | | | | | | | | | | | | |
| | | | | change score sd (imputed) | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.01 | 0.00 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.01 | 0.00 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.01 | 0.00 | 0.00 | 0.00 | | | |
| | | | | pre-post sd | | 0.06 | 0.07 | 0.04 | 0.00 | | | |
| | | | | pre-post sd | | 5.26 | 1.30 | 3.32 | 11.05 | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pre-post sd | | 3.03 | -0.70 | 1.91 | 3.66 | | | |
| | | | | pre-post sd | | 0.00 | 1.24 | | | | | |
| | | | | pre-post sd | | 2.02 | -0.70 | 1.28 | 1.64 | | | |
| | | | | pre-post sd | | 231.71 | 0.00 | 146.55 | 21476.54 | | | |
| | | | | pre-post sd | | 0.06 | 0.09 | 0.04 | 0.00 | | | |
| | | | | pre-post sd | | 7.00 | 0.10 | 4.43 | 19.61 | | | |
| | | | | pre-post sd | | 2.59 | -2.90 | 1.64 | 2.69 | | | |
| | | | | pre-post sd | | 0.00 | 2.05 | | | | | |
| | | | | pre-post sd | | 2.10 | 2.00 | 1.33 | 1.76 | | | |
| | | | | pre-post sd | | 195.14 | 0.00 | 123.42 | 15231.41 | | | |
| | | | | | | | | | | | | |
| 2.70 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 2.61 |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |
| 2.36 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 3.09 |
| | | | | pre-post sd | | 3.13 | 0.00 | 0.68 | 0.47 | | | |
| | | | | pre-post sd | | 1.09 | 0.00 | 0.24 | 0.06 | | | |
| | | | | pre-post sd | | 1.80 | 0.00 | 0.39 | 0.16 | | | |
| | | | | | | | 0.00 | | | | | |
| | | | | pre-post sd | | 2.68 | 3.10 | 0.59 | 0.34 | | | |
| | | | | pre-post sd | | 113.22 | 0.00 | 24.77 | 613.52 | | | |
| | | | | other | | 9.79 | -0.60 | 2.14 | 4.59 | -4.8 | 3.6 | |
| | | | | other | | 10.03 | 2.60 | 2.19 | 4.81 | -1.6 | 6.9 | |
| | | | | other | | 19.82 | 7.50 | 4.34 | 18.81 | -0.9 | 16 | |
| | | | | other | | 49.91 | 17.20 | 10.92 | 119.21 | -4.3 | 38.6 | |
| | | | | other | | 34.98 | 21.00 | 7.65 | 58.57 | 6 | 36 | |
| | | | | other | | 46.64 | 36.00 | 10.20 | 104.12 | 24 | 56 | |
| | | | | other | | 1.63 | -0.30 | 0.36 | 0.13 | -0.7 | 0.4 | |
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| | | | | | | | -3.00 | | | | | |
| | | | | | | | -1.20 | | | | | |
| | | | | | | | -0.10 | | | | | |
| | | | | | | | -1.99 | | | | | |
| | | | | pre-post sd | | 114.66 | 0.00 | 31.51 | 992.58 | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 4.50 | -0.30 | 1.17 | 1.38 | -2.7 | 2 | |
| | | | | | | 4.31 | -0.20 | 1.12 | 1.26 | -2 | 2 | |
| | | | | | | 6.66 | -0.30 | 1.73 | 3.01 | -3.6 | 3.1 | |
| | | | | | | 1.76 | 0.10 | 0.46 | 0.21 | -0.9 | 1 | |
| | | | | | | 0.10 | 0.03 | 0.03 | 0.00 | -0.01 | 0.08 | |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |
| | | | | | | | -6.00 | | | | | |
| | | | | | | | -1.40 | | | | | |
| | | | | | | | -1.90 | | | | | |
| | | | | pre-post sd | | 106.99 | 0.00 | 30.36 | 921.62 | | | |
| | | | | | | 4.54 | 0.10 | 1.22 | 1.50 | -2.4 | 2.5 | |
| | | | | | | 4.35 | -1.00 | 1.17 | 1.38 | -3.3 | 1.3 | |
| | | | | | | 6.80 | -2.60 | 1.84 | 3.37 | -6.2 | 1 | |
| | | | | | | 1.89 | -0.90 | 0.51 | 0.26 | -1.9 | 0.1 | |
| | | | | | | 0.09 | 0.06 | 0.03 | 0.00 | 0.01 | 0.11 | |
| 1.80 | | | | | change score sd (imputed) | 0.00 | -0.01 | | | | | 2.18 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 1.80 | | | | | change score sd (imputed) | 0.00 | 0.01 | | | | | 2.07 |
| | | | | change score sd (imputed) | | 1.64 | -0.45 | 0.43 | 0.18 | | | |
| | | | | change score sd (imputed) | | 0.64 | -0.21 | 0.17 | 0.03 | | | |
| | | | | change score sd (imputed) | | 1.72 | -0.16 | 0.45 | 0.20 | | | |
| | | | | change score sd (imputed) | | 4.04 | 0.03 | 1.05 | 1.11 | | | |
| | | | | change score sd (imputed) | | 4.43 | 0.52 | 1.15 | 1.33 | | | |
| | | | | change score sd (imputed) | | 47.57 | 3.90 | 12.39 | 153.46 | | | |
| | | | | change score sd (imputed) | | 47.73 | -2.90 | 12.43 | 154.52 | | | |
| | | | | pre-post sd | | 2.54 | -0.50 | 0.66 | 0.44 | | | |
| 1.80 | | | | | change score sd (imputed) | 0.00 | -0.04 | | | | | 1.57 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 1.80 | | | | | change score sd (imputed) | 0.00 | -0.03 | | | | | 2.01 |
| | | | | change score sd (imputed) | | 1.53 | -0.12 | 0.40 | 0.16 | | | |
| | | | | change score sd (imputed) | | 0.58 | -0.16 | 0.15 | 0.02 | | | |
| | | | | change score sd (imputed) | | 1.69 | -0.47 | 0.44 | 0.20 | | | |
| | | | | change score sd (imputed) | | 3.87 | 0.32 | 1.02 | 1.03 | | | |
| | | | | change score sd (imputed) | | 4.97 | 1.87 | 1.30 | 1.70 | | | |
| | | | | change score sd (imputed) | | 47.57 | 7.10 | 12.49 | 156.03 | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | change score sd (imputed) | | 54.59 | -6.20 | 14.34 | 205.55 | | | |
| | | | | pre-post sd | | 2.72 | -0.70 | 0.71 | 0.51 | | | |
| 2.40 | | | | | change score sd (imputed) | 0.00 | 0.03 | | | | | 2.45 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 2.70 | | | | | change score sd (imputed) | 0.00 | 0.07 | | | | | 2.52 |
| | | | | | change score sd (imputed) | 1.67 | 0.51 | 0.44 | 0.19 | | | |
| | | | | change score sd (imputed) | | 0.75 | 0.35 | 0.20 | 0.04 | | | |
| | | | | change score sd (imputed) | | 1.41 | 0.38 | 0.37 | 0.14 | | | |
| | | | | change score sd (imputed) | | 4.74 | 0.97 | 1.24 | 1.55 | | | |
| | | | | change score sd (imputed) | | 4.44 | -1.18 | 1.17 | 1.36 | | | |
| | | | | change score sd (imputed) | | 155.34 | 2.00 | 40.82 | 1666.08 | | | |
| | | | | change score sd (imputed) | | 31.16 | -9.93 | 8.19 | 67.06 | | | |
| | | | | pre-post sd | | 2.01 | 0.10 | 0.53 | 0.28 | | | |
| 2.40 | | | | | change score sd (imputed) | 0.00 | 0.02 | | | | | 3.61 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 2.70 | | | | | change score sd (imputed) | 0.00 | 0.06 | | | | | 2.65 |
| | | | | change score sd (imputed) | | 1.65 | 0.32 | 0.43 | 0.18 | | | |
| | | | | change score sd (imputed) | | 0.77 | -0.06 | 0.20 | 0.04 | | | |
| | | | | change score sd (imputed) | | 1.62 | 0.14 | 0.42 | 0.17 | | | |
| | | | | change score sd (imputed) | | 4.42 | -1.42 | 1.14 | 1.30 | | | |
| | | | | change score sd (imputed) | | 5.16 | 1.06 | 1.33 | 1.78 | | | |
| | | | | change score sd (imputed) | | 189.08 | -11.10 | 48.82 | 2383.33 | | | |
| | | | | change score sd (imputed) | | 36.78 | -3.40 | 9.50 | 90.18 | | | |
| | | | | pre-post sd | | 2.03 | 0.00 | 0.52 | 0.27 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 3.39 | | | | pre-post sd | change score sd (imputed) | 0.03 | 0.02 | 0.01 | 0.00 | | | 3.14 |
| | | | | pre-post sd | | 0.05 | 0.11 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.10 | 0.12 | 0.05 | 0.00 | | | |
| | | | | pre-post sd | | 0.27 | -0.73 | 0.13 | 0.02 | | | |
| | | | | pre-post sd | | 2.43 | 3.62 | 1.14 | 1.31 | | | |
| | | | | pre-post sd | | 6.21 | -4.80 | 2.93 | 8.57 | | | |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 3.07 | | -0.24 | 0.91 | change score sd (imputed) | confidence interval | 0.03 | 0.01 | 0.00 | 0.00 | 0.006 | 0.021 | 2.92 |
| 3.47 | | -1.70 | -0.40 | change score sd (imputed) | confidence interval | 0.02 | 0.02 | 0.00 | 0.00 | 0.008 | 0.021 | 3.47 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pre-post sd | | 1.01 | -0.62 | 0.13 | 0.02 | | | |
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| | | | | | | | | | | | | |
| 2.20 | | | | | change score sd (imputed) | 0.00 | -0.01 | | | | | 3.29 |
| 2.10 | | | | | change score sd (imputed) | 0.00 | 0.01 | | | | | 2.59 |
| 2.40 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 2.77 |
| 5.20 | | | | | change score sd (imputed) | 0.00 | 0.01 | | | | | 4.64 |
| 2.30 | | | | | change score sd (imputed) | 0.00 | 0.01 | | | | | 3.45 |
| 1.90 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 2.63 |
| 2.20 | | | | | change score sd (imputed) | 0.00 | 0.03 | | | | | 2.92 |
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| | | | | | | | | | | | | |
| 3.60 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 3.22 |
| 2.50 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 2.45 |
| 3.10 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 3.69 |
| 6.60 | | | | | change score sd (imputed) | 0.00 | 0.02 | | | | | 7.83 |
| 3.50 | | | | | change score sd (imputed) | 0.00 | -0.01 | | | | | 4.85 |
| 2.30 | | | | | change score sd (imputed) | 0.00 | -0.01 | | | | | 1.90 |
| 2.40 | | | | | change score sd (imputed) | 0.00 | 0.01 | | | | | 2.61 |
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Outcome Characteristics

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| | | | | | | | | | | | | |
| 1.98 | | | | | change score sd (imputed) | 0.00 | 0.04 | | | | | 2.04 |
| 1.97 | | | | | change score sd (imputed) | 0.00 | 0.03 | | | | | 1.89 |
| 2.74 | | | | | change score sd (imputed) | 0.00 | 0.03 | | | | | 2.59 |
| 2.57 | | | | | change score sd (imputed) | 0.00 | 0.04 | | | | | 2.39 |
| 2.60 | | | | | change score sd (imputed) | 0.00 | 0.04 | | | | | 2.69 |
| 3.03 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 2.93 |
| 2.24 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 2.24 |
| 2.42 | | | | | change score sd (imputed) | 0.00 | -0.01 | | | | | 2.51 |
| 1.69 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 1.57 |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |
| 1.98 | | | | | change score sd (imputed) | 0.00 | 0.03 | | | | | 1.92 |
| 1.97 | | | | | change score sd (imputed) | 0.00 | 0.05 | | | | | 1.90 |
| 2.74 | | | | | change score sd (imputed) | 0.00 | 0.05 | | | | | 2.68 |
| 2.57 | | | | | change score sd (imputed) | 0.00 | 0.05 | | | | | 2.53 |
| 2.60 | | | | | change score sd (imputed) | 0.00 | 0.04 | | | | | 2.44 |
| 3.03 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 3.10 |
| 2.24 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 2.07 |
| 2.42 | | | | | change score sd (imputed) | 0.00 | -0.01 | | | | | 2.46 |
| 1.69 | | | | | change score sd (imputed) | 0.00 | 0.00 | | | | | 1.71 |
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| | | | | | | | | | | | | |
| 2.83 | | | | pre-post sd | change score sd (imputed) | 0.07 | -0.01 | 0.02 | 0.00 | | | 2.82 |
| 2.13 | | | | pre-post sd | change score sd (imputed) | 0.03 | 0.02 | 0.01 | 0.00 | | | 2.22 |
| 1.67 | | | | pre-post sd | change score sd (imputed) | 0.04 | 0.00 | 0.01 | 0.00 | | | 1.96 |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |
| 2.30 | | | | pre-post sd | change score sd (imputed) | 0.07 | 0.02 | 0.02 | 0.00 | | | 2.49 |
| 2.31 | | | | pre-post sd | change score sd (imputed) | 0.04 | 0.02 | 0.01 | 0.00 | | | 2.30 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.92 | | | | pre-post sd | change score sd (imputed) | 0.05 | 0.01 | 0.01 | 0.00 | | | 1.97 |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |
| 4.06 | | -1.60 | 2.20 | | confidence interval | 0.00 | -0.01 | | | | | 3.95 |
| 5.45 | | -2.80 | 2.30 | | confidence interval | 0.00 | 0.02 | | | | | 5.11 |
| 2.03 | | -0.70 | 1.20 | | confidence interval | 0.00 | 0.00 | | | | | 2.05 |
| 2.35 | | -1.20 | 1.00 | | confidence interval | 0.00 | 0.03 | | | | | 2.47 |
| 2.35 | | -2.00 | 0.20 | | confidence interval | 0.00 | 0.01 | | | | | 2.77 |
| 3.21 | | -0.70 | 2.30 | | confidence interval | 0.00 | 0.01 | | | | | 3.73 |
| 4.38 | | -2.80 | 1.30 | | confidence interval | 0.00 | -0.01 | | | | | 4.85 |
| 2.99 | | -0.20 | 2.60 | | confidence interval | 0.00 | -0.01 | | | | | 2.67 |
| 10.68 | | -3.70 | 6.30 | | confidence interval | 0.00 | 2.00 | | | | | 10.63 |
| 2.78 | | -1.50 | 1.10 | | confidence interval | 0.00 | 0.20 | | | | | 3.43 |
| 584.38 | | -277.00 | 270.00 | | confidence interval | 0.00 | 36.00 | | | | | 501.68 |
| 29.91 | | 2.70 | 30.70 | | confidence interval | 0.00 | 8.00 | | | | | 29.30 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 4.06 | | -1.60 | 2.20 | | confidence interval | 0.00 | -0.01 | | | | | 4.13 |
| 5.45 | | -2.80 | 2.30 | | confidence interval | 0.00 | -0.01 | | | | | 5.66 |
| 2.03 | | -0.70 | 1.20 | | confidence interval | 0.00 | -0.01 | | | | | 2.10 |
| 2.35 | | -1.20 | 1.00 | | confidence interval | 0.00 | 0.01 | | | | | 2.43 |
| 2.35 | | -2.00 | 0.20 | | confidence interval | 0.00 | -0.01 | | | | | 3.85 |
| 3.21 | | -0.70 | 2.30 | | confidence interval | 0.00 | -0.01 | | | | | 3.08 |
| 4.38 | | -2.80 | 1.30 | | confidence interval | 0.00 | 0.01 | | | | | 4.97 |
| 2.99 | | -0.20 | 2.60 | | confidence interval | 0.00 | -0.03 | | | | | 2.76 |
| 10.68 | | -3.70 | 6.30 | | confidence interval | 0.00 | 1.00 | | | | | 10.94 |
| 2.78 | | -1.50 | 1.10 | | confidence interval | 0.00 | 0.70 | | | | | 3.15 |
| 584.38 | | -277.00 | 270.00 | | confidence interval | 0.00 | 149.00 | | | | | 527.02 |
| 29.91 | | 2.70 | 30.70 | | confidence interval | 0.00 | -1.00 | | | | | 29.72 |
| | | | | change score sd (imputed) | | 2.91 | -0.20 | 0.73 | 0.53 | | | |
| | | | | change score sd (imputed) | | 1.05 | 0.10 | 0.26 | 0.07 | | | |
| | | | | change score sd (imputed) | | 1.35 | 0.30 | 0.34 | 0.11 | | | |
| | | | | confidence interval | | 0.02 | 0.00 | 0.01 | 0.00 | | | |
| | | | | confidence interval | | 0.02 | 0.00 | 0.00 | 0.00 | | | |
| | | | | confidence interval | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | confidence interval | | 6.42 | 1.70 | 1.63 | 2.66 | | | |
| | | | | confidence interval | | 4.97 | 0.79 | 1.26 | 1.60 | | | |
| | | | | confidence interval | | 15.05 | 4.93 | 3.82 | 14.63 | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | confidence interval | | 58.61 | 8.28 | 14.89 | 221.82 | | | |
| | | | | confidence interval | | 3.53 | -0.21 | 0.92 | 0.84 | | | |
| | | | | confidence interval | | 17.89 | -1.21 | 4.67 | 21.76 | | | |
| | | | | confidence interval | | 12.42 | 0.69 | 3.24 | 10.48 | | | |
| | | | | confidence interval | | 3.66 | 1.67 | 1.10 | 1.22 | | | |
| | | | | confidence interval | | 2.97 | 0.91 | 0.90 | 0.81 | | | |
| | | | | confidence interval | | 28.78 | 18.93 | 8.69 | 75.47 | | | |
| | | | | confidence interval | | 14.14 | 5.95 | 4.27 | 18.22 | | | |
| | | | | confidence interval | | 9.23 | -0.86 | 2.49 | 6.20 | | | |
| | | | | confidence interval | | 32.86 | -4.14 | 8.86 | 78.57 | | | |
| | | | | confidence interval | | 70.53 | 6.00 | 19.02 | 361.91 | | | |
| | | | | change score sd (imputed) | | 2.05 | 0.00 | 0.51 | 0.26 | | | |
| | | | | change score sd (imputed) | | 1.00 | 0.00 | 0.25 | 0.06 | | | |
| | | | | change score sd (imputed) | | 1.45 | -0.10 | 0.36 | 0.13 | | | |
| | | | | confidence interval | | 0.02 | 0.00 | 0.00 | 0.00 | | | |
| | | | | confidence interval | | 0.02 | 0.01 | 0.00 | 0.00 | | | |
| | | | | confidence interval | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | confidence interval | | 6.37 | 1.56 | 1.61 | 2.58 | | | |
| | | | | confidence interval | | 6.45 | -0.34 | 1.63 | 2.64 | | | |
| | | | | confidence interval | | 14.95 | 10.31 | 3.77 | 14.22 | | | |
| | | | | confidence interval | | 58.24 | 13.58 | 14.69 | 215.82 | | | |
| | | | | confidence interval | | 3.50 | -0.73 | 0.91 | 0.82 | | | |
| | | | | confidence interval | | 17.74 | -6.57 | 4.59 | 21.08 | | | |
| | | | | confidence interval | | 12.33 | 3.09 | 3.19 | 10.18 | | | |
| | | | | confidence interval | | 3.65 | -0.04 | 1.00 | 1.01 | | | |
| | | | | confidence interval | | 2.97 | 0.05 | 0.82 | 0.67 | | | |
| | | | | confidence interval | | 28.71 | -1.01 | 7.90 | 62.44 | | | |
| | | | | confidence interval | | 14.11 | 0.40 | 3.88 | 15.08 | | | |
| | | | | confidence interval | | 9.33 | -5.17 | 2.41 | 5.83 | | | |
| | | | | confidence interval | | 32.97 | -13.54 | 8.53 | 72.80 | | | |
| | | | | confidence interval | | 86.69 | 12.37 | 22.43 | 503.27 | | | |
| | | | | pre-post sd | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.06 | 0.02 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.06 | 0.01 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.05 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.07 | 0.02 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | | | | 4.50 | | | | | |
| | | | | | | | 1.43 | | | | | |
| | | | | | | | 4.80 | | | | | |

Outcome Characteristics

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| | | | | | | | 0.25 | | | | | |
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| | | | | | | | | | | | | |
| | | | | pre-post sd | | 1.96 | 0.20 | 0.57 | 0.33 | | | |
| | | | | pre-post sd | | 3.24 | 4.00 | 0.95 | 0.90 | | | |
| | | | | pre-post sd | | 2.26 | -3.00 | 0.66 | 0.44 | | | |
| | | | | pre-post sd | | 0.46 | -0.90 | 0.14 | 0.02 | | | |
| | | | | pre-post sd | | 6.52 | 10.00 | 1.90 | 3.63 | | | |
| | | | | pre-post sd | | 7.81 | 16.50 | 2.28 | 5.19 | | | |
| | | | | pre-post sd | | 7.56 | 11.80 | 2.21 | 4.86 | | | |
| | | | | pre-post sd | | 13.12 | 22.50 | 3.83 | 14.66 | | | |
| | | | | pre-post sd | | 9.90 | 21.80 | 2.89 | 8.34 | | | |
| | | | | pre-post sd | | 0.03 | -0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.03 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.06 | 0.02 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.05 | 0.02 | 0.01 | 0.00 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | pre-post sd | | 1.79 | 0.80 | 0.52 | 0.27 | | | |
| | | | | pre-post sd | | 2.43 | 1.10 | 0.70 | 0.49 | | | |
| | | | | pre-post sd | | 2.02 | -0.20 | 0.58 | 0.34 | | | |
| | | | | pre-post sd | | 0.52 | -1.10 | 0.15 | 0.02 | | | |
| | | | | pre-post sd | | 7.36 | 8.70 | 2.12 | 4.51 | | | |
| | | | | pre-post sd | | 9.77 | -1.10 | 2.82 | 7.95 | | | |
| | | | | pre-post sd | | 6.31 | 5.20 | 1.82 | 3.32 | | | |
| | | | | pre-post sd | | 14.71 | -0.40 | 4.25 | 18.02 | | | |
| | | | | pre-post sd | | 8.78 | 7.30 | 2.54 | 6.43 | | | |
| | | | | pre-post sd | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.03 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.06 | 0.01 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.05 | 0.01 | 0.01 | 0.00 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | pre-post sd | | 1.72 | 0.50 | 0.44 | 0.20 | | | |
| | | | | pre-post sd | | 1.77 | -2.30 | 0.46 | 0.21 | | | |
| | | | | pre-post sd | | 2.49 | 1.30 | 0.64 | 0.41 | | | |
| | | | | pre-post sd | | 29.89 | -10.30 | 7.72 | 59.56 | | | |
| | | | | pre-post sd | | 2.39 | 1.70 | 0.62 | 0.38 | | | |
| | | | | pre-post sd | | 0.57 | -0.40 | 0.15 | 0.02 | | | |
| | | | | pre-post sd | | 6.43 | 8.20 | 1.66 | 2.76 | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pre-post sd | | 2.15 | 0.30 | 0.56 | 0.31 | | | |
| | | | | pre-post sd | | 10.66 | -2.90 | 2.75 | 7.57 | | | |
| | | | | pre-post sd | | 10.07 | -2.10 | 2.60 | 6.76 | | | |
| | | | | pre-post sd | | 7.88 | 1.20 | 2.03 | 4.14 | | | |
| | | | | pre-post sd | | 6.71 | 7.30 | 1.73 | 3.00 | | | |
| | | | | pre-post sd | | 17.50 | 6.30 | 4.52 | 20.42 | | | |
| | | | | pre-post sd | | 15.17 | 10.20 | 3.92 | 15.35 | | | |
| | | | | pre-post sd | | 10.16 | -1.70 | 2.62 | 6.89 | | | |
| | | | | pre-post sd | | 8.98 | 4.80 | 2.32 | 5.38 | | | |
| | | | | pre-post sd | | 0.03 | 0.03 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.06 | 0.01 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.02 | 0.01 | 0.00 | | | |
| 3.40 | | | | pre-post sd | change score sd (imputed) | 0.07 | 0.00 | 0.02 | 0.00 | | | 3.52 |
| | | | | pre-post sd | | 6.59 | -2.10 | 2.11 | 4.46 | | | |
| | | | | | | | -0.81 | | | | | |
| | | | | pre-post sd | | 1.94 | 3.70 | 0.62 | 0.39 | | | |
| 3.40 | | | | pre-post sd | change score sd (imputed) | 0.08 | 0.02 | 0.03 | 0.00 | | | 3.95 |
| | | | | pre-post sd | | 6.79 | -2.80 | 2.30 | 5.31 | | | |
| | | | | | | | -1.09 | | | | | |
| | | | | pre-post sd | | 2.07 | 3.80 | 0.70 | 0.49 | | | |
| 3.80 | | | | change score sd (imputed) | change score sd (imputed) | 0.04 | 0.03 | 0.01 | 0.00 | | | 4.17 |
| 3.50 | | | | change score sd (imputed) | change score sd (imputed) | 0.03 | 0.03 | 0.01 | 0.00 | | | 3.55 |
| | | | | | | | -2.50 | | | | | |
| | | | | | | | -1.30 | | | | | |
| | | | | pre-post sd | | 145.39 | 6.00 | 46.58 | 2169.50 | | | |
| | | | | pre-post sd | | 7.42 | 22.60 | 2.38 | 5.65 | | | |
| | | | | pre-post sd | | 4.74 | 14.40 | 1.52 | 2.31 | | | |
| | | | | pre-post sd | | 2.21 | 11.10 | 0.71 | 0.50 | | | |
| | | | | pre-post sd | | 3.54 | 12.60 | 1.14 | 1.29 | | | |
| | | | | pre-post sd | | 2.49 | 6.60 | 0.80 | 0.64 | | | |
| | | | | pre-post sd | | 3.26 | -5.90 | 1.04 | 1.09 | | | |
| | | | | pre-post sd | | 560.97 | 3641.00 | 179.71 | 32297.11 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | pre-post sd | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.00 | 0.01 | 0.00 | | | |
| 1.26 | | | | | change score sd (imputed) | 0.00 | 4.72 | | | | | 1.34 |

## Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.96 | | | | | change score sd (imputed) | 0.00 | 2.26 | | | | | 1.40 |
| 1.30 | | | | | change score sd (imputed) | 0.00 | 1.59 | | | | | 1.75 |
| 1.37 | | | | | change score sd (imputed) | 0.00 | 1.92 | | | | | 1.86 |
| 1.24 | | | | | change score sd (imputed) | 0.00 | 0.63 | | | | | 1.52 |
| 1.21 | | | | | change score sd (imputed) | 0.00 | 3.20 | | | | | 1.58 |
| 1.55 | | | | | change score sd (imputed) | 0.00 | 2.24 | | | | | 1.97 |
| 1.34 | | | | | change score sd (imputed) | 0.00 | -17.03 | | | | | 1.83 |
| | | | | pre-post sd | | 5.60 | 1.10 | 1.82 | 3.31 | | | |
| | | | | pre-post sd | | 0.05 | 0.06 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.06 | 0.05 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.05 | 0.03 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.08 | 0.03 | 0.03 | 0.00 | | | |
| | | | | pre-post sd | | 1.75 | 2.00 | 0.57 | 0.32 | | | |
| | | | | pre-post sd | | 1.19 | 3.70 | 0.39 | 0.15 | | | |
| | | | | pre-post sd | | 4.31 | 18.40 | 1.40 | 1.96 | | | |
| | | | | pre-post sd | | 0.41 | 2.40 | 0.13 | 0.02 | | | |
| | | | | pre-post sd | | 2.01 | 12.00 | 0.65 | 0.43 | | | |
| | | | | pre-post sd | | 1.98 | 4.50 | 0.64 | 0.41 | | | |
| | | | | | | | | | | | | |
| | | | | change score sd (imputed) | | 1.28 | 2.30 | 0.35 | 0.12 | | | |
| | | | | change score sd (imputed) | | 3.55 | -0.40 | 0.98 | 0.95 | | | |
| | | | | change score sd (imputed) | | 2.11 | 2.10 | 0.58 | 0.34 | | | |
| | | | | change score sd (imputed) | | 3.88 | -3.00 | 1.07 | 1.13 | | | |
| | | | | change score sd (imputed) | | 0.02 | 0.02 | 0.00 | 0.00 | | | |
| | | | | change score sd (imputed) | | 136.78 | 180.00 | 37.58 | 1412.45 | | | |
| | | | | change score sd (imputed) | | 1.21 | -1.50 | 0.33 | 0.11 | | | |
| | | | | change score sd (imputed) | | 7.88 | 5.70 | 2.17 | 4.69 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.01 | 0.01 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.01 | 0.01 | 0.00 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | pre-post sd | | 0.08 | 0.05 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.07 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.07 | 0.03 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.12 | 0.03 | 0.02 | 0.00 | | | |
| | | | | pre-post sd | | 0.08 | 0.05 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 149.80 | 23.00 | 28.68 | 822.67 | | | |
| | | | | pre-post sd | | 52.20 | -14.00 | 10.00 | 99.90 | | | |
| | | | | change score sem | | 11.17 | 7.00 | 1.84 | 3.38 | | | |
| | | | | change score sem | | 62.82 | 19.20 | 10.33 | 106.74 | | | |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | change score sem | | 5.59 | 0.00 | 0.92 | 0.84 | | | |
| | | | | change score sem | | 4.73 | -1.10 | 0.78 | 0.60 | | | |
| | | | | change score sem | | 2.17 | 0.80 | 0.36 | 0.13 | | | |
| | | | | pre-post sd | | 0.04 | 0.01 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.04 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 0.08 | 0.01 | 0.01 | 0.00 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 1.97 | 0.38 | | | | change score sem | 0.00 | 0.03 | | | | | 2.69 |
| 4.94 | 0.95 | | | | change score sem | 0.00 | 0.01 | | | | | 4.35 |
| 4.05 | 0.78 | | | | change score sem | 0.00 | 0.02 | | | | | 3.66 |
| 4.42 | 0.85 | | | | change score sem | 0.00 | 0.01 | | | | | 4.49 |
| 5.56 | 1.07 | | | | change score sem | 0.00 | 0.03 | | | | | 5.72 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | change score sd (imputed) | | 0.04 | 0.03 | 0.02 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.03 | 0.00 | 0.01 | 0.00 | | | |
| | | | | pre-post sd | | 3.24 | -0.60 | 0.81 | 0.66 | | | |
| | | | | pre-post sd | | 1.16 | -0.20 | 0.29 | 0.08 | | | |
| | | | | pre-post sd | | 92.02 | 15.30 | 23.02 | 529.73 | | | |
| | | | | pre-post sd | change score sd (imputed) | 7.37 | -3.80 | 1.84 | 3.40 | | | |
| 1.55 | | | | pre-post sd | change score sd (imputed) | 0.04 | 0.01 | 0.01 | 0.00 | | | 1.56 |
| 2.39 | | | | pre-post sd | change score sd (imputed) | 1.81 | -0.20 | 0.45 | 0.20 | | | 2.33 |
| 6.75 | | | | pre-post sd | change score sd (imputed) | 1.96 | -0.50 | 0.49 | 0.24 | | | 6.56 |
| 2.64 | | | | pre-post sd | change score sd (imputed) | 0.06 | -0.01 | 0.01 | 0.00 | | | 2.46 |
| 1.99 | | | | pre-post sd | change score sd (imputed) | 0.05 | 0.00 | 0.01 | 0.00 | | | 2.15 |
| 3.74 | | | | pre-post sd | change score sd (imputed) | 0.05 | 0.00 | 0.01 | 0.00 | | | 3.91 |
| 2.80 | | | | pre-post sd | change score sd (imputed) | 0.05 | 0.00 | 0.01 | 0.00 | | | 3.13 |
| | | | | change score sd (imputed) | | 0.37 | -0.04 | 0.09 | 0.04 | | | |
| | | | | change score sd (imputed) | | 1.70 | -0.90 | 0.90 | 0.81 | | | |
| | | | | change score sd (imputed) | | 0.07 | 0.01 | 0.04 | 0.00 | | | |
| | | | | change score sd (imputed) | | 0.22 | 0.15 | 0.12 | 0.01 | | | |
| | | | | change score sd (imputed) | | 0.20 | -0.09 | 0.10 | 0.01 | | | |

Outcome Characteristics

| p_te | p_te_se | p_te_var | p_te_lci | p_te_uci | te_met | te_met_p | g_met | g | g_var | g_se |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.50 | 0.62 | 0.38 | | | | percent change score sds | relative values | 0.27 | 0.12 | 0.34 |
| -0.60 | 1.02 | 1.03 | | | | percent change score sds | relative values | -0.20 | 0.12 | 0.34 |
| 1.50 | 0.74 | 0.54 | | | | percent change score sds | relative values | 0.68 | 0.12 | 0.35 |
| 0.70 | 1.02 | 1.03 | | | | percent change score sds | relative values | 0.23 | 0.12 | 0.34 |
| 2.18 | | | | | change score sds | | absolute values | 0.33 | 0.12 | 0.34 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1.20 | 0.64 | 0.41 | | | | percent change score sds | relative values | 0.65 | 0.14 | 0.37 |
| 1.40 | 1.06 | 1.12 | | | | percent change score sds | relative values | 0.47 | 0.13 | 0.37 |
| 1.20 | 0.76 | 0.57 | | | | percent change score sds | relative values | 0.56 | 0.13 | 0.37 |
| -0.10 | 1.04 | 1.09 | | | | percent change score sds | relative values | -0.03 | 0.13 | 0.36 |
| 2.37 | | | | | change score sds | | absolute values | 0.33 | 0.13 | 0.36 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 2.00 | 0.62 | 0.38 | | | | percent change score sds | relative values | 1.08 | 0.13 | 0.36 |
| 2.10 | 1.00 | 1.00 | | | | percent change score sds | relative values | 0.70 | 0.12 | 0.35 |
| 2.00 | 0.72 | 0.52 | | | | percent change score sds | relative values | 0.92 | 0.13 | 0.36 |
| -1.00 | 1.00 | 1.00 | | | | percent change score sds | relative values | -0.33 | 0.12 | 0.34 |
| 2.38 | | | | | change score sds | | absolute values | 0.35 | 0.12 | 0.34 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| -0.01 | | | | | change score sds | | absolute values | -0.06 | 0.07 | 0.27 |
| 1.65 | | | | | change score sds | | absolute values | 0.47 | 0.08 | 0.27 |
| 2.56 | | | | | change score sds | | absolute values | 0.57 | 0.08 | 0.28 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.07 | 0.27 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.07 | 0.27 |
| 2.50 | | | | | change score sds | | absolute values | 0.19 | 0.07 | 0.27 |
| 3.49 | | | | | change score sds | | absolute values | 0.34 | 0.07 | 0.27 |
| -0.09 | | | | | change score sds | | absolute values | -0.03 | 0.05 | 0.23 |
| -1.14 | | | | | change score sds | | absolute values | -0.31 | 0.05 | 0.23 |
| -0.42 | | | | | change score sds | | absolute values | -0.12 | 0.05 | 0.23 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.05 | 0.23 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.05 | 0.23 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.05 | 0.23 |
| -0.36 | | | | | change score sds | | absolute values | -0.15 | 0.09 | 0.30 |
| 0.22 | | | | | change score sds | | absolute values | 0.07 | 0.09 | 0.30 |
| 0.51 | | | | | change score sds | | absolute values | 0.14 | 0.09 | 0.30 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.09 | 0.30 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.09 | 0.30 |

Outcome Characteristics

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.09 | 0.30 |
| 9.63 | | | | | change score sds | | absolute values | 0.66 | 0.09 | 0.30 |
| | | | | | | | | | | |
| -13.96 | | | | | change score sds | | absolute values | -1.15 | 0.05 | 0.23 |
| 0.37 | | | | | change score sds | | absolute values | 0.10 | 0.04 | 0.21 |
| 0.57 | | | | | change score sds | | absolute values | 0.13 | 0.04 | 0.21 |
| 0.92 | | | | | change score sds | | absolute values | 0.23 | 0.04 | 0.21 |
| -0.73 | | | | | change score sds | | absolute values | -0.16 | 0.04 | 0.21 |
| -13.96 | | | | | change score sds | | absolute values | -1.15 | 0.04 | 0.21 |
| 0.08 | | | | | change score sds | | absolute values | 0.02 | 0.04 | 0.19 |
| 0.18 | | | | | change score sds | | absolute values | 0.04 | 0.04 | 0.19 |
| 0.34 | | | | | change score sds | | absolute values | 0.09 | 0.04 | 0.19 |
| -0.48 | | | | | change score sds | | absolute values | -0.11 | 0.04 | 0.19 |
| | | | | | | | | | | |
| 1.99 | | | | | change score sds | | absolute values | 0.60 | 0.16 | 0.40 |
| 0.09 | | | | | change score sds | | absolute values | 0.00 | 0.15 | 0.39 |
| | | | | | | | other | 0.25 | 0.15 | 0.39 |
| 1.49 | 0.17 | 0.03 | | | change score sds | percent change score sds | absolute values | 5.99 | 0.88 | 0.94 |
| 0.85 | 0.14 | 0.02 | | | change score sds | percent change score sds | absolute values | 3.47 | 0.41 | 0.64 |
| 65.72 | | | | | change score sds | | absolute values | 1.46 | 0.21 | 0.46 |
| 80.45 | | | | | change score sds | | absolute values | 1.36 | 0.20 | 0.45 |
| -7.35 | | | | | change score sds | | absolute values | -0.11 | 0.17 | 0.41 |
| -14.42 | | | | | change score sds | | absolute values | -0.12 | 0.17 | 0.41 |
| -16.13 | | | | | change score sds | | absolute values | -0.14 | 0.17 | 0.41 |
| -2.99 | | | | | change score sds | | absolute values | -0.66 | 0.23 | 0.48 |
| -11.32 | | | | | change score sds | | absolute values | -1.17 | 0.26 | 0.51 |
| 20.28 | | | | | change score sds | | absolute values | 3.03 | 0.48 | 0.69 |
| 17.63 | | | | | change score sds | | absolute values | 2.06 | 0.34 | 0.58 |
| 26.25 | | | | | change score sds | | absolute values | 4.10 | 0.69 | 0.83 |
| 38.01 | | | | | change score sds | | absolute values | 4.19 | 0.71 | 0.84 |
| 31.22 | | | | | change score sds | | absolute values | 3.88 | 0.64 | 0.80 |
| -0.62 | | | | | change score sds | | absolute values | -0.37 | 0.23 | 0.48 |
| 0.42 | | | | | change score sds | | absolute values | 0.14 | 0.22 | 0.47 |
| -0.48 | | | | | change score sds | | absolute values | -0.18 | 0.22 | 0.47 |
| 1.44 | | | | | change score sds | | absolute values | 0.27 | 0.22 | 0.47 |
| 0.36 | | | | | change score sds | | absolute values | 0.12 | 0.22 | 0.47 |
| -4.26 | | | | | change score sds | | absolute values | -0.75 | 0.23 | 0.48 |
| -9.03 | | | | | change score sds | | absolute values | -0.78 | 0.23 | 0.48 |
| 16.11 | | | | | change score sds | | absolute values | 1.57 | 0.28 | 0.53 |
| 14.57 | | | | | change score sds | | absolute values | 1.61 | 0.28 | 0.53 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|
| 23.42 | | | | | change score sds | | absolute values | 2.81 | 0.42 | 0.65 |
| 43.45 | | | | | change score sds | | absolute values | 3.48 | 0.53 | 0.73 |
| 15.66 | | | | | change score sds | | absolute values | 1.95 | 0.31 | 0.56 |
| -1.86 | | | | | change score sds | | absolute values | -0.97 | 0.24 | 0.49 |
| -1.61 | | | | | change score sds | | absolute values | -0.64 | 0.22 | 0.47 |
| 0.58 | | | | | change score sds | | absolute values | 0.23 | 0.21 | 0.46 |
| -2.04 | | | | | change score sds | | absolute values | -0.46 | 0.22 | 0.47 |
| 0.98 | | | | | change score sds | | absolute values | 0.44 | 0.22 | 0.46 |
| 1.06 | | | | | change score sds | | absolute values | 0.17 | 0.05 | 0.23 |
| 0.59 | | | | | change score sds | | absolute values | 0.11 | 0.05 | 0.23 |
| 2.09 | | | | | change score sds | | absolute values | 0.29 | 0.05 | 0.23 |
| -1.47 | | | | | | | | | | |
| -1.33 | | | | | | | | | | |
| 1.92 | | | | | change score sds | | absolute values | 0.15 | 0.05 | 0.23 |
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| -0.50 | 1.34 | 1.81 | | | change score sds | percent change score sds | absolute values | -0.09 | 0.18 | 0.43 |
| 0.50 | 1.09 | 1.18 | | | change score sds | percent change score sds | absolute values | 0.09 | 0.18 | 0.43 |
| 0.30 | 1.20 | 1.44 | | | change score sds | percent change score sds | absolute values | 0.02 | 0.18 | 0.43 |
| 0.40 | 1.49 | 2.21 | | | change score sds | percent change score sds | absolute values | 0.03 | 0.18 | 0.43 |
| -1.70 | 1.34 | 1.80 | | | change score sds | percent change score sds | absolute values | -0.26 | 0.18 | 0.43 |
| 0.60 | 0.57 | 0.33 | | | change score sds | percent change score sds | absolute values | 0.17 | 0.18 | 0.43 |
| 92.00 | 21.59 | 466.24 | | | change score sds | percent change score sds | absolute values | 2.29 | 0.30 | 0.55 |
| 29.00 | 5.61 | 31.52 | | | change score sds | percent change score sds | absolute values | 1.85 | 0.26 | 0.51 |
| -0.43 | | | | | change score sds | | absolute values | -0.06 | 0.10 | 0.32 |
| -0.39 | | | | | change score sds | | absolute values | -0.06 | 0.10 | 0.32 |
| -2.59 | | | | | change score sds | | absolute values | -0.22 | 0.10 | 0.32 |
| 1.71 | | | | | change score sds | | absolute values | 0.35 | 0.10 | 0.32 |
| -3.45 | | | | | change score sds | | absolute values | -0.62 | 0.11 | 0.33 |
| 0.88 | | | | | change score sds | | absolute values | 0.26 | 0.10 | 0.32 |
| -2.73 | | | | | change score sds | | absolute values | -0.42 | 0.10 | 0.32 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.10 | 0.32 |
| 2.24 | | | | | change score sds | | absolute values | 0.44 | 0.10 | 0.32 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.10 | 0.32 |
| -9.37 | | | | | change score sds | | absolute values | -1.15 | 0.12 | 0.34 |
| 0.15 | | | | | change score sds | | absolute values | 0.02 | 0.10 | 0.32 |
| 0.04 | | | | | change score sds | | absolute values | 0.00 | 0.10 | 0.32 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|
| -0.53 | | | | | change score sds | | absolute values | -0.13 | 0.10 | 0.32 |
| 0.10 | 1.07 | 1.15 | -1.3 | 2.2 | change score sds | percent change treatment e | absolute values | 0.00 | 0.10 | 0.32 |
| 0.00 | 1.43 | 2.04 | -1.9 | 2.8 | change score sds | percent change treatment e | absolute values | 0.00 | 0.10 | 0.32 |
| 2.10 | 0.66 | 0.44 | -0.4 | 3.4 | change score sds | percent change treatment e | absolute values | 0.24 | 0.10 | 0.32 |
| 0.00 | 1.33 | 1.76 | -3.8 | 2.6 | change score sds | percent change treatment e | absolute values | 0.00 | 0.10 | 0.32 |
| 3.40 | 1.99 | 3.96 | -1.2 | 7.3 | change score sds | percent change treatment e | absolute values | 0.46 | 0.10 | 0.32 |
| 8.40 | 2.30 | 5.27 | 1.8 | 12.9 | change score sds | percent change treatment e | absolute values | 0.97 | 0.11 | 0.33 |
| 9.90 | 6.12 | 37.48 | 0.2 | 21.9 | change score sds | percent change treatment e | absolute values | 1.23 | 0.12 | 0.35 |
| 6.80 | 4.54 | 20.62 | -2.7 | 15.7 | change score sds | percent change treatment e | absolute values | 0.76 | 0.11 | 0.33 |
| 11.40 | 2.70 | 7.31 | 6.9 | 16.7 | change score sds | percent change treatment e | absolute values | 1.26 | 0.12 | 0.35 |
| 33.00 | 77.50 | 6006.25 | -298.1 | 184.9 | change score sds | percent change treatment e | absolute values | 0.21 | 0.10 | 0.32 |
| 0.70 | 1.07 | 1.15 | -1.4 | 2.8 | change score sds | percent change treatment e | absolute values | 0.45 | 0.10 | 0.32 |
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| 1.10 | 0.67 | 0.45 | | | | percent change score sds | relative values | 0.41 | 0.06 | 0.25 |
| 2.40 | 1.11 | 1.23 | | | | percent change score sds | relative values | 0.54 | 0.07 | 0.26 |
| 2.30 | 1.23 | 1.50 | | | | percent change score sds | relative values | 0.47 | 0.07 | 0.26 |
| 12.60 | 4.12 | 16.98 | | | change score sds | percent change score sds | absolute values | 0.72 | 0.07 | 0.26 |
| 10.70 | 6.28 | 39.42 | | | change score sds | percent change score sds | absolute values | 0.64 | 0.07 | 0.26 |
| 7.80 | 6.33 | 40.06 | | | change score sds | percent change score sds | absolute values | 0.51 | 0.07 | 0.26 |
| 11.20 | 10.64 | 113.15 | | | change score sds | percent change score sds | absolute values | 0.58 | 0.07 | 0.26 |
| 4.20 | 6.49 | 42.10 | | | change score sds | percent change score sds | absolute values | 0.30 | 0.06 | 0.25 |
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| 0.56 | | | | | change score sds | | absolute values | 0.17 | 0.03 | 0.17 |
| 1.87 | | | | | change score sds | | absolute values | 0.49 | 0.03 | 0.17 |
| -0.15 | | | | | change score sds | | absolute values | -0.08 | 0.03 | 0.17 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.03 | 0.17 |
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| | | | | | | | | | | |
| 1.05 | | | | | change score sds | | absolute values | 0.25 | 0.03 | 0.18 |
| 1.22 | | | | | change score sds | | absolute values | 0.35 | 0.03 | 0.18 |
| 0.56 | | | | | change score sds | | absolute values | 0.22 | 0.03 | 0.18 |
| 0.37 | | | | | change score sds | | absolute values | 0.33 | 0.03 | 0.18 |
| 6.09 | | | | | change score sds | | absolute values | 1.08 | 0.46 | 0.68 |
| 1.85 | | | | | change score sds | | absolute values | 0.22 | 0.40 | 0.63 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|
| -1.11 | | | | | change score sds | | absolute values | -0.21 | 0.40 | 0.63 |
| 3.19 | | | | | | | | | | |
| -3.10 | | | | | change score sds | | absolute values | -0.31 | 0.40 | 0.64 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.40 | 0.63 |
| 7.80 | | | | | change score sds | | absolute values | 1.43 | 0.50 | 0.71 |
| 0.18 | | | | | change score sds | | absolute values | 0.01 | 0.40 | 0.63 |
| -6.90 | | | | | change score sds | | absolute values | -1.01 | 0.45 | 0.67 |
| 5.09 | | | | | | | | | | |
| 9.07 | | | | | change score sds | | absolute values | 0.86 | 0.44 | 0.66 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.40 | 0.63 |
| | | | | | | | other | 0.32 | 0.05 | 0.22 |
| 1.00 | 0.57 | 0.33 | | | change score sds | percent change score sds | relative values | 0.38 | 0.05 | 0.22 |
| | | | | | | | other | 0.15 | 0.05 | 0.22 |
| | | | | | | | other | 0.22 | 0.05 | 0.22 |
| | | | | | | | other | 0.23 | 0.05 | 0.22 |
| | | | | | | | other | 0.75 | 0.05 | 0.23 |
| | | | | | | | other | 0.43 | 0.05 | 0.22 |
| -0.80 | 0.68 | 0.46 | | | | percent change score sds | relative values | -0.26 | 0.05 | 0.22 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.05 | 0.22 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.05 | 0.22 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.05 | 0.22 |
| 0.00 | | | | | | | | | | |
| 8.52 | | | | | change score sds | | absolute values | 1.14 | 0.06 | 0.24 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.05 | 0.22 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | -0.06 | 0.05 | 0.22 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | 0.26 | 0.05 | 0.22 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | 0.37 | 0.05 | 0.22 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | 0.34 | 0.05 | 0.22 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | 0.59 | 0.05 | 0.22 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | 0.76 | 0.05 | 0.23 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | -0.18 | 0.05 | 0.22 |
| | | | | | | | other | 0.04 | 0.08 | 0.27 |
| | | | | | | | other | -0.11 | 0.08 | 0.27 |
| | | | | | | | other | 0.05 | 0.08 | 0.27 |
| | | | | | | | other | -0.12 | 0.08 | 0.28 |
| 0.00 | | | | | | | | | | |
| 0.00 | | | | | | | | | | |
| 0.00 | | | | | | | | | | |
| 0.00 | | | | | | | | | | |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.08 | 0.27 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | | | | treatment effect confidence interval | | absolute values | -0.07 | 0.07 | 0.26 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | -0.05 | 0.07 | 0.26 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | -0.04 | 0.07 | 0.26 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | 0.06 | 0.07 | 0.26 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | 0.30 | 0.07 | 0.26 |
| | | | | | | | other | -0.14 | 0.08 | 0.28 |
| | | | | | | | other | 0.25 | 0.08 | 0.28 |
| | | | | | | | other | -0.03 | 0.08 | 0.28 |
| | | | | | | | other | -0.38 | 0.08 | 0.29 |
| 0.00 | | | | | | | | | | |
| 0.00 | | | | | | | | | | |
| 0.00 | | | | | | | | | | |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.08 | 0.28 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | 0.02 | 0.07 | 0.27 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | -0.23 | 0.07 | 0.27 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | -0.38 | 0.07 | 0.27 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | -0.47 | 0.07 | 0.27 |
| 0.00 | | | | | treatment effect confidence interval | | absolute values | 0.63 | 0.08 | 0.28 |
| -0.12 | 0.57 | 0.32 | | | | percent change score sds | relative values | -0.05 | 0.07 | 0.26 |
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| 0.56 | 0.54 | 0.29 | | | | percent change score sds | relative values | 0.27 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.27 | 0.07 | 0.26 |
| -0.89 | | | | | change score sds | | absolute values | -0.33 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.09 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.01 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.12 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.08 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.06 | 0.07 | 0.26 |
| -1.10 | | | | | change score sds | | absolute values | -0.19 | 0.07 | 0.26 |
| -0.71 | 0.41 | 0.17 | | | | percent change score sds | relative values | -0.45 | 0.07 | 0.27 |
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| 0.35 | 0.53 | 0.28 | | | | percent change score sds | relative values | 0.17 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.08 | 0.07 | 0.26 |
| -0.67 | | | | | change score sds | | absolute values | -0.27 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.27 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.08 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.37 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.15 | 0.07 | 0.26 |

Outcome Characteristics

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| | | | | | change score sds | | absolute values | -0.11 | 0.07 | 0.26 |
| -1.54 | | | | | change score sds | | absolute values | -0.25 | 0.07 | 0.26 |
| 2.51 | 0.64 | 0.41 | | | | percent change score sds | relative values | 1.01 | 0.08 | 0.28 |
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| -0.89 | 0.66 | 0.44 | | | | percent change score sds | relative values | -0.35 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.30 | 0.07 | 0.26 |
| 1.46 | | | | | change score sds | | absolute values | 0.46 | 0.07 | 0.27 |
| | | | | | change score sds | | absolute values | 0.27 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.20 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.26 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.01 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.31 | 0.07 | 0.26 |
| 0.28 | | | | | change score sds | | absolute values | 0.05 | 0.07 | 0.26 |
| 2.30 | 0.93 | 0.87 | | | | percent change score sds | relative values | 0.63 | 0.07 | 0.26 |
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| 1.01 | 0.68 | 0.47 | | | | percent change score sds | relative values | 0.38 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.19 | 0.07 | 0.26 |
| -0.23 | | | | | change score sds | | absolute values | -0.08 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.09 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.32 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | 0.20 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.06 | 0.07 | 0.26 |
| | | | | | change score sds | | absolute values | -0.09 | 0.07 | 0.26 |
| -0.01 | | | | | change score sds | | absolute values | 0.00 | 0.07 | 0.26 |
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| 3.33 | 1.31 | 1.73 | | | change score sds | percent change score sds | relative values | 1.03 | 0.19 | 0.44 |
| 15.58 | | | | | change score sds | | absolute values | 2.22 | 0.36 | 0.60 |
| 15.16 | | | | | change score sds | | absolute values | 1.12 | 0.26 | 0.51 |
| -29.63 | | | | | change score sds | | absolute values | -2.53 | 0.40 | 0.63 |
| 15.55 | | | | | change score sds | | absolute values | 1.42 | 0.28 | 0.53 |
| -6.10 | | | | | change score sds | | absolute values | -0.74 | 0.24 | 0.49 |
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| 1.44 | 0.39 | 0.15 | | | treatment effect confidence interval | percent change score sds | absolute values | 0.52 | 0.02 | 0.13 |
| 2.06 | 0.46 | 0.21 | | | treatment effect confidence interval | percent change score sds | absolute values | 0.65 | 0.02 | 0.14 |

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|---|---|---|---|---|---|---|---|---|---|---|
| -134.61 | | | | | change score sds | | absolute values | -0.61 | 0.02 | 0.14 |
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| 2.30 | 0.97 | 0.94 | | | | percent change score sds | relative values | 0.69 | 0.09 | 0.30 |
| 1.60 | 0.76 | 0.58 | | | | percent change score sds | relative values | 0.61 | 0.09 | 0.30 |
| 0.40 | 0.82 | 0.67 | | | | percent change score sds | relative values | 0.14 | 0.09 | 0.30 |
| 1.50 | 1.37 | 1.87 | | | | percent change score sds | relative values | 0.32 | 0.09 | 0.30 |
| 3.80 | 0.98 | 0.95 | | | | percent change score sds | relative values | 1.08 | 0.09 | 0.30 |
| 1.20 | 0.74 | 0.55 | | | | percent change score sds | relative values | 0.45 | 0.08 | 0.29 |
| 1.10 | 0.83 | 0.68 | | | | percent change score sds | relative values | 0.37 | 0.08 | 0.29 |
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| -0.90 | 1.05 | 1.09 | | | | percent change score sds | relative values | -0.27 | 0.11 | 0.33 |
| -0.20 | 0.80 | 0.63 | | | | percent change score sds | relative values | -0.08 | 0.11 | 0.32 |
| 1.20 | 1.20 | 1.43 | | | | percent change score sds | relative values | 0.32 | 0.11 | 0.33 |
| 1.00 | 2.54 | 6.46 | | | | percent change score sds | relative values | 0.12 | 0.11 | 0.32 |
| 0.10 | 1.50 | 2.24 | | | | percent change score sds | relative values | 0.02 | 0.10 | 0.31 |
| 1.10 | 0.59 | 0.35 | | | | percent change score sds | relative values | 0.57 | 0.10 | 0.31 |
| 1.00 | 0.80 | 0.65 | | | | percent change score sds | relative values | 0.38 | 0.10 | 0.31 |
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Outcome Characteristics

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| -0.64 | 0.54 | 0.29 | | | | percent change score sds | relative values | -0.31 | 0.07 | 0.27 |
| 1.14 | 0.50 | 0.25 | | | | percent change score sds | relative values | 0.60 | 0.07 | 0.27 |
| 0.01 | 0.68 | 0.46 | | | | percent change score sds | relative values | 0.00 | 0.07 | 0.26 |
| 1.88 | 0.63 | 0.40 | | | | percent change score sds | relative values | 0.78 | 0.07 | 0.27 |
| 1.15 | 0.71 | 0.50 | | | | percent change score sds | relative values | 0.42 | 0.07 | 0.27 |
| -0.16 | 0.77 | 0.60 | | | | percent change score sds | relative values | -0.05 | 0.07 | 0.26 |
| 0.12 | 0.59 | 0.35 | | | | percent change score sds | relative values | 0.05 | 0.07 | 0.26 |
| -0.12 | 0.66 | 0.44 | | | | percent change score sds | relative values | -0.05 | 0.07 | 0.26 |
| 0.09 | 0.41 | 0.17 | | | | percent change score sds | relative values | 0.06 | 0.07 | 0.26 |
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| -0.31 | 0.48 | 0.23 | | | | percent change score sds | relative values | -0.16 | 0.06 | 0.25 |
| -0.08 | 0.47 | 0.22 | | | | percent change score sds | relative values | -0.04 | 0.06 | 0.25 |
| -0.01 | 0.66 | 0.44 | | | | percent change score sds | relative values | 0.00 | 0.06 | 0.25 |
| 0.11 | 0.63 | 0.39 | | | | percent change score sds | relative values | 0.04 | 0.06 | 0.25 |
| 0.14 | 0.60 | 0.36 | | | | percent change score sds | relative values | 0.06 | 0.06 | 0.25 |
| 0.16 | 0.77 | 0.59 | | | | percent change score sds | relative values | 0.05 | 0.06 | 0.25 |
| -0.74 | 0.51 | 0.26 | | | | percent change score sds | relative values | -0.35 | 0.06 | 0.25 |
| -1.01 | 0.61 | 0.37 | | | | percent change score sds | relative values | -0.41 | 0.06 | 0.25 |
| -0.08 | 0.42 | 0.18 | | | | percent change score sds | relative values | -0.05 | 0.06 | 0.25 |
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| -0.25 | 0.61 | 0.37 | | | change score sds | percent change score sds | relative values | -0.09 | 0.05 | 0.22 |
| 2.04 | 0.48 | 0.23 | | | change score sds | percent change score sds | relative values | 0.91 | 0.05 | 0.23 |
| 0.14 | 0.42 | 0.18 | | | change score sds | percent change score sds | relative values | 0.07 | 0.05 | 0.22 |
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| 1.10 | 0.54 | 0.29 | | | change score sds | percent change score sds | relative values | 0.44 | 0.05 | 0.22 |
| 1.69 | 0.50 | 0.25 | | | change score sds | percent change score sds | relative values | 0.73 | 0.05 | 0.22 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|
| 0.07 | 0.42 | 0.18 | | | change score sds | percent change score sds | relative values | 0.04 | 0.05 | 0.22 |
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| 0.50 | 1.35 | 1.82 | | | | percent change score sds | relative values | 0.12 | 0.12 | 0.34 |
| -0.20 | 1.74 | 3.04 | | | | percent change score sds | relative values | -0.04 | 0.12 | 0.34 |
| 0.20 | 0.70 | 0.49 | | | | percent change score sds | relative values | 0.10 | 0.12 | 0.34 |
| 0.60 | 0.84 | 0.71 | | | | percent change score sds | relative values | 0.24 | 0.12 | 0.34 |
| 1.40 | 0.95 | 0.89 | | | | percent change score sds | relative values | 0.49 | 0.12 | 0.35 |
| -0.30 | 1.27 | 1.62 | | | | percent change score sds | relative values | -0.08 | 0.12 | 0.34 |
| 1.80 | 1.66 | 2.74 | | | | percent change score sds | relative values | 0.36 | 0.12 | 0.34 |
| -0.50 | 0.91 | 0.83 | | | | percent change score sds | relative values | -0.18 | 0.12 | 0.34 |
| -0.30 | 3.63 | 13.19 | | | | percent change score sds | relative values | -0.03 | 0.12 | 0.34 |
| 0.00 | 1.17 | 1.37 | | | | percent change score sds | relative values | 0.00 | 0.12 | 0.34 |
| 2.60 | 171.36 | 29362.90 | | | | percent change score sds | relative values | 0.01 | 0.12 | 0.34 |
| 38.00 | 10.01 | 100.14 | | | | percent change score sds | relative values | 1.27 | 0.14 | 0.37 |
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| 4.10 | 1.39 | 1.92 | | | | percent change score sds | relative values | 0.97 | 0.13 | 0.35 |
| 1.10 | 1.90 | 3.60 | | | | percent change score sds | relative values | 0.19 | 0.11 | 0.34 |
| 1.20 | 0.70 | 0.49 | | | | percent change score sds | relative values | 0.56 | 0.12 | 0.34 |
| -0.90 | 0.82 | 0.67 | | | | percent change score sds | relative values | -0.36 | 0.11 | 0.34 |
| 0.20 | 1.29 | 1.67 | | | | percent change score sds | relative values | 0.05 | 0.11 | 0.34 |
| -1.10 | 1.03 | 1.07 | | | | percent change score sds | relative values | -0.35 | 0.11 | 0.34 |
| -1.30 | 1.67 | 2.78 | | | | percent change score sds | relative values | -0.26 | 0.11 | 0.34 |
| -0.10 | 0.93 | 0.86 | | | | percent change score sds | relative values | -0.04 | 0.11 | 0.34 |
| -3.70 | 3.67 | 13.47 | | | | percent change score sds | relative values | -0.33 | 0.11 | 0.34 |
| 0.70 | 1.06 | 1.12 | | | | percent change score sds | relative values | 0.22 | 0.11 | 0.34 |
| 19.40 | 176.77 | 31246.38 | | | | percent change score sds | relative values | 0.04 | 0.11 | 0.34 |
| -3.00 | 9.97 | 99.34 | | | | percent change score sds | relative values | -0.10 | 0.11 | 0.34 |
| -0.47 | | | | | change score sds | | absolute values | -0.07 | 0.06 | 0.25 |
| 0.30 | | | | | change score sds | | absolute values | 0.09 | 0.06 | 0.25 |
| 1.15 | | | | | change score sds | | absolute values | 0.22 | 0.06 | 0.25 |
| -0.29 | | | | | change score sds | | absolute values | -0.10 | 0.07 | 0.26 |
| -0.18 | | | | | change score sds | | absolute values | -0.05 | 0.07 | 0.26 |
| 1.58 | | | | | change score sds | | absolute values | 0.22 | 0.07 | 0.26 |
| 0.76 | | | | | change score sds | | absolute values | 0.26 | 0.07 | 0.26 |
| 0.37 | | | | | change score sds | | absolute values | 0.16 | 0.06 | 0.25 |
| 0.46 | | | | | change score sds | | absolute values | 0.32 | 0.07 | 0.26 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 0.53 | | | | | change score sds | | absolute values | 0.14 | 0.06 | 0.25 |
| -0.13 | | | | | change score sds | | absolute values | -0.06 | 0.07 | 0.26 |
| -0.18 | | | | | change score sds | | absolute values | -0.07 | 0.07 | 0.26 |
| 0.28 | | | | | change score sds | | absolute values | 0.05 | 0.07 | 0.26 |
| 2.94 | | | | | change score sds | | absolute values | 0.45 | 0.09 | 0.31 |
| 1.78 | | | | | change score sds | | absolute values | 0.30 | 0.09 | 0.30 |
| 1.73 | | | | | change score sds | | absolute values | 0.65 | 0.10 | 0.31 |
| | | | | | change score sds | | absolute values | 0.41 | 0.09 | 0.31 |
| -1.85 | | | | | change score sds | | absolute values | -0.09 | 0.07 | 0.27 |
| -3.87 | | | | | change score sds | | absolute values | -0.12 | 0.07 | 0.27 |
| 1.24 | | | | | change score sds | | absolute values | 0.08 | 0.07 | 0.27 |
| -0.07 | | | | | change score sds | | absolute values | 0.00 | 0.06 | 0.25 |
| 0.03 | | | | | change score sds | | absolute values | 0.00 | 0.06 | 0.25 |
| -0.46 | | | | | change score sds | | absolute values | -0.07 | 0.06 | 0.25 |
| 0.43 | | | | | change score sds | | absolute values | 0.16 | 0.06 | 0.25 |
| 0.84 | | | | | change score sds | | absolute values | 0.26 | 0.06 | 0.25 |
| 1.12 | | | | | change score sds | | absolute values | 0.17 | 0.06 | 0.25 |
| 0.73 | | | | | change score sds | | absolute values | 0.24 | 0.06 | 0.25 |
| -0.13 | | | | | change score sds | | absolute values | -0.05 | 0.06 | 0.25 |
| 0.96 | | | | | change score sds | | absolute values | 0.68 | 0.07 | 0.26 |
| 0.99 | | | | | change score sds | | absolute values | 0.23 | 0.06 | 0.25 |
| -0.44 | | | | | change score sds | | absolute values | -0.21 | 0.07 | 0.26 |
| -1.16 | | | | | change score sds | | absolute values | -0.37 | 0.07 | 0.26 |
| 1.07 | | | | | change score sds | | absolute values | 0.25 | 0.07 | 0.26 |
| 0.00 | | | | | change score sds | | absolute values | -0.01 | 0.08 | 0.28 |
| 0.13 | | | | | change score sds | | absolute values | 0.02 | 0.08 | 0.28 |
| -0.08 | | | | | change score sds | | absolute values | -0.03 | 0.08 | 0.28 |
| | | | | | change score sds | | absolute values | 0.03 | 0.08 | 0.28 |
| -9.27 | | | | | change score sds | | absolute values | -0.55 | 0.07 | 0.26 |
| -11.40 | | | | | change score sds | | absolute values | -0.41 | 0.07 | 0.26 |
| 2.59 | | | | | change score sds | | absolute values | 0.14 | 0.07 | 0.26 |
| -0.28 | | | | | change score sds | | absolute values | -0.09 | 0.07 | 0.27 |
| 1.84 | | | | | change score sds | | absolute values | 0.38 | 0.08 | 0.28 |
| 1.35 | | | | | change score sds | | absolute values | 0.22 | 0.08 | 0.27 |
| 1.86 | | | | | change score sds | | absolute values | 0.30 | 0.08 | 0.28 |
| 2.60 | | | | | change score sds | | absolute values | 0.33 | 0.08 | 0.28 |
| 0.03 | | | | | change score sds | | absolute values | 0.00 | 0.07 | 0.27 |
| 0.00 | | | | | | | | | | |
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Outcome Characteristics

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| 0.00 | | | | | | | | | | |
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| 0.76 | | | | | change score sds | | absolute values | 0.10 | 0.09 | 0.29 |
| 9.74 | | | | | change score sds | | absolute values | 1.21 | 0.10 | 0.32 |
| -7.72 | | | | | change score sds | | absolute values | -1.30 | 0.10 | 0.32 |
| -15.91 | | | | | change score sds | | absolute values | -1.91 | 0.12 | 0.35 |
| 37.63 | | | | | change score sds | | absolute values | 1.51 | 0.11 | 0.33 |
| 21.47 | | | | | change score sds | | absolute values | 2.08 | 0.13 | 0.36 |
| 23.36 | | | | | change score sds | | absolute values | 1.54 | 0.11 | 0.33 |
| 17.96 | | | | | change score sds | | absolute values | 1.69 | 0.12 | 0.34 |
| 29.46 | | | | | change score sds | | absolute values | 2.17 | 0.14 | 0.37 |
| -0.87 | | | | | change score sds | | absolute values | -0.17 | 0.09 | 0.29 |
| 4.21 | | | | | change score sds | | absolute values | 0.75 | 0.09 | 0.30 |
| 2.17 | | | | | change score sds | | absolute values | 0.34 | 0.09 | 0.29 |
| 2.47 | | | | | change score sds | | absolute values | 0.43 | 0.09 | 0.30 |
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| 2.85 | | | | | change score sds | | absolute values | 0.44 | 0.09 | 0.29 |
| 2.78 | | | | | change score sds | | absolute values | 0.44 | 0.09 | 0.29 |
| -0.48 | | | | | change score sds | | absolute values | -0.10 | 0.08 | 0.29 |
| -18.56 | | | | | change score sds | | absolute values | -2.06 | 0.13 | 0.36 |
| 31.34 | | | | | change score sds | | absolute values | 1.16 | 0.10 | 0.31 |
| -1.20 | | | | | change score sds | | absolute values | -0.11 | 0.08 | 0.29 |
| 10.92 | | | | | change score sds | | absolute values | 0.81 | 0.09 | 0.30 |
| -0.20 | | | | | change score sds | | absolute values | -0.03 | 0.08 | 0.29 |
| 10.30 | | | | | change score sds | | absolute values | 0.82 | 0.09 | 0.30 |
| 0.75 | | | | | change score sds | | absolute values | 0.12 | 0.08 | 0.29 |
| 1.58 | | | | | change score sds | | absolute values | 0.29 | 0.08 | 0.29 |
| 0.81 | | | | | change score sds | | absolute values | 0.14 | 0.08 | 0.29 |
| 0.96 | | | | | change score sds | | absolute values | 0.17 | 0.08 | 0.29 |
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| 1.77 | | | | | change score sds | | absolute values | 0.29 | 0.07 | 0.26 |
| -6.06 | | | | | change score sds | | absolute values | -1.28 | 0.08 | 0.28 |
| 3.31 | | | | | change score sds | | absolute values | 0.52 | 0.07 | 0.26 |
| -2.11 | | | | | change score sds | | absolute values | -0.34 | 0.07 | 0.26 |
| 6.89 | | | | | change score sds | | absolute values | 0.70 | 0.07 | 0.27 |
| -7.44 | | | | | change score sds | | absolute values | -0.69 | 0.07 | 0.27 |
| 27.71 | | | | | change score sds | | absolute values | 1.26 | 0.08 | 0.28 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 0.26 | | | | | change score sds | | absolute values | 0.14 | 0.07 | 0.26 |
| -3.79 | | | | | change score sds | | absolute values | -0.27 | 0.07 | 0.26 |
| -2.52 | | | | | change score sds | | absolute values | -0.21 | 0.07 | 0.26 |
| 2.25 | | | | | change score sds | | absolute values | 0.15 | 0.07 | 0.26 |
| 14.60 | | | | | change score sds | | absolute values | 1.07 | 0.08 | 0.28 |
| 4.53 | | | | | change score sds | | absolute values | 0.36 | 0.07 | 0.26 |
| 8.01 | | | | | change score sds | | absolute values | 0.66 | 0.07 | 0.27 |
| -2.30 | | | | | change score sds | | absolute values | -0.17 | 0.07 | 0.26 |
| 6.59 | | | | | change score sds | | absolute values | 0.53 | 0.07 | 0.26 |
| 3.61 | | | | | change score sds | | absolute values | 0.73 | 0.07 | 0.27 |
| 0.65 | | | | | change score sds | | absolute values | 0.13 | 0.07 | 0.26 |
| 0.71 | | | | | change score sds | | absolute values | 0.12 | 0.07 | 0.26 |
| 0.36 | | | | | change score sds | | absolute values | 0.07 | 0.07 | 0.26 |
| 1.86 | | | | | change score sds | | absolute values | 0.40 | 0.07 | 0.26 |
| 0.13 | 1.13 | 1.27 | | | change score sds | percent change score sds | absolute values | 0.04 | 0.10 | 0.32 |
| -2.91 | | | | | change score sds | | absolute values | -0.31 | 0.10 | 0.32 |
| -2.95 | | | | | | | | | | |
| 15.98 | | | | | change score sds | | absolute values | 1.86 | 0.15 | 0.38 |
| 1.42 | 1.34 | 1.80 | | | change score sds | percent change score sds | absolute values | 0.21 | 0.12 | 0.34 |
| -4.01 | | | | | change score sds | | absolute values | -0.40 | 0.12 | 0.34 |
| -4.04 | | | | | | | | | | |
| 16.08 | | | | | change score sds | | absolute values | 1.79 | 0.16 | 0.40 |
| 3.40 | 1.34 | 1.79 | | | change score sds | percent change score sds | absolute values | 0.71 | 0.11 | 0.33 |
| 2.80 | 1.14 | 1.29 | | | change score sds | percent change score sds | absolute values | 0.81 | 0.11 | 0.33 |
| 0.00 | | | | | | | | | | |
| 0.00 | | | | | | | | | | |
| 0.16 | | | | | change score sds | | absolute values | 0.04 | 0.10 | 0.32 |
| 31.70 | | | | | change score sds | | absolute values | 2.98 | 0.22 | 0.47 |
| 58.40 | | | | | change score sds | | absolute values | 2.97 | 0.22 | 0.46 |
| 57.10 | | | | | change score sds | | absolute values | 4.91 | 0.41 | 0.64 |
| 52.10 | | | | | change score sds | | absolute values | 3.48 | 0.26 | 0.51 |
| 45.80 | | | | | change score sds | | absolute values | 2.60 | 0.19 | 0.43 |
| -22.80 | | | | | change score sds | | absolute values | -1.77 | 0.14 | 0.38 |
| 24.95 | | | | | change score sds | | absolute values | 6.36 | 0.62 | 0.79 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1.27 | | | | | change score sds | | absolute values | 0.27 | 0.08 | 0.29 |
| 1.14 | | | | | change score sds | | absolute values | 0.22 | 0.08 | 0.29 |
| 0.02 | | | | | change score sds | | absolute values | 0.00 | 0.08 | 0.29 |
| 0.54 | 0.33 | 0.11 | | | | percent change score sds | relative values | 0.40 | 0.06 | 0.25 |

Outcome Characteristics

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|---|---|---|---|---|---|---|---|---|---|---|
| 0.27 | 0.35 | 0.12 | | | | percent change score sds | relative values | 0.19 | 0.06 | 0.25 |
| 0.22 | 0.43 | 0.19 | | | | percent change score sds | relative values | 0.12 | 0.06 | 0.25 |
| 0.31 | 0.46 | 0.21 | | | | percent change score sds | relative values | 0.16 | 0.06 | 0.25 |
| 0.06 | 0.38 | 0.14 | | | | percent change score sds | relative values | 0.04 | 0.06 | 0.25 |
| 0.46 | 0.39 | 0.15 | | | | percent change score sds | relative values | 0.29 | 0.06 | 0.25 |
| 0.32 | 0.48 | 0.24 | | | | percent change score sds | relative values | 0.16 | 0.06 | 0.25 |
| 0.60 | 0.45 | 0.20 | | | | percent change score sds | relative values | 0.32 | 0.06 | 0.25 |
| 1.77 | | | | | change score sds | | absolute values | 0.19 | 0.11 | 0.33 |
| 7.63 | | | | | change score sds | | absolute values | 1.21 | 0.12 | 0.35 |
| 7.80 | | | | | change score sds | | absolute values | 0.89 | 0.12 | 0.34 |
| 4.25 | | | | | change score sds | | absolute values | 0.59 | 0.11 | 0.33 |
| 2.73 | | | | | change score sds | | absolute values | 0.38 | 0.11 | 0.33 |
| 8.13 | | | | | change score sds | | absolute values | 1.12 | 0.12 | 0.35 |
| 27.63 | | | | | change score sds | | absolute values | 3.03 | 0.23 | 0.48 |
| 18.49 | | | | | change score sds | | absolute values | 4.18 | 0.34 | 0.58 |
| 55.87 | | | | | change score sds | | absolute values | 5.68 | 0.53 | 0.73 |
| 54.35 | | | | | change score sds | | absolute values | 5.84 | 0.55 | 0.74 |
| 15.31 | | | | | change score sds | | absolute values | 2.23 | 0.17 | 0.41 |
| | | | | | | | | | | |
| 13.57 | | | | | change score sds | | absolute values | 1.77 | 0.11 | 0.32 |
| -0.41 | | | | | change score sds | | absolute values | -0.11 | 0.08 | 0.27 |
| 3.65 | | | | | change score sds | | absolute values | 0.98 | 0.08 | 0.29 |
| -7.07 | | | | | change score sds | | absolute values | -0.76 | 0.08 | 0.28 |
| 2.08 | | | | | change score sds | | absolute values | 1.18 | 0.09 | 0.30 |
| 34.71 | | | | | change score sds | | absolute values | 1.30 | 0.09 | 0.30 |
| -13.76 | | | | | change score sds | | absolute values | -1.22 | 0.09 | 0.30 |
| 46.87 | | | | | change score sds | | absolute values | 0.71 | 0.08 | 0.28 |
| 0.52 | | | | | change score sds | | absolute values | 0.19 | 0.08 | 0.28 |
| 0.47 | | | | | change score sds | | absolute values | 0.16 | 0.08 | 0.28 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 6.25 | | | | | change score sds | | absolute values | 0.62 | 0.04 | 0.20 |
| 1.69 | | | | | change score sds | | absolute values | 0.14 | 0.04 | 0.19 |
| 4.55 | | | | | change score sds | | absolute values | 0.44 | 0.04 | 0.19 |
| 3.04 | | | | | change score sds | | absolute values | 0.26 | 0.04 | 0.19 |
| 4.63 | | | | | change score sds | | absolute values | 0.65 | 0.04 | 0.20 |
| 2.22 | | | | | change score sds | | absolute values | 0.15 | 0.04 | 0.19 |
| -52.22 | | | | | change score sds | | absolute values | -0.27 | 0.04 | 0.19 |
| 7.91 | | | | | change score sds | | absolute values | 0.62 | 0.03 | 0.17 |
| 6.45 | | | | | change score sds | | absolute values | 0.30 | 0.03 | 0.17 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| -0.01 | | | | | change score sds | | absolute values | 0.00 | 0.03 | 0.16 |
| -3.18 | | | | | change score sds | | absolute values | -0.23 | 0.03 | 0.17 |
| 1.80 | | | | | change score sds | | absolute values | 0.37 | 0.03 | 0.17 |
| 1.18 | | | | | change score sds | | absolute values | 0.26 | 0.03 | 0.17 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.03 | 0.16 |
| 0.00 | | | | | change score sds | | absolute values | 0.00 | 0.03 | 0.16 |
| 0.77 | | | | | change score sds | | absolute values | 0.13 | 0.03 | 0.16 |
| | | | | | | | other | 0.51 | 0.05 | 0.22 |
| | | | | | | | other | 0.55 | 0.09 | 0.29 |
| | | | | | | | other | 0.52 | 0.08 | 0.27 |
| -1.25 | 0.72 | 0.53 | | | | percent change score sds | relative values | -0.46 | 0.07 | 0.27 |
| -1.57 | 1.17 | 1.38 | | | | percent change score sds | relative values | -0.36 | 0.07 | 0.27 |
| -1.70 | 0.99 | 0.97 | | | | percent change score sds | relative values | -0.46 | 0.07 | 0.27 |
| -1.68 | 1.21 | 1.46 | | | | percent change score sds | relative values | -0.37 | 0.07 | 0.27 |
| -0.53 | 1.54 | 2.38 | | | | percent change score sds | relative values | -0.09 | 0.07 | 0.27 |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| 2.82 | | | | | change score sds | | absolute values | 0.77 | 0.21 | 0.46 |
| 0.22 | | | | | change score sds | | absolute values | 0.06 | 0.20 | 0.45 |
| -1.07 | | | | | change score sds | | absolute values | -0.18 | 0.06 | 0.25 |
| -0.86 | | | | | change score sds | | absolute values | -0.17 | 0.06 | 0.25 |
| 2.61 | | | | | change score sds | | absolute values | 0.16 | 0.06 | 0.25 |
| -24.87 | 0.00 | | | | change score sds | percent change score sds | absolute values | -0.51 | 0.06 | 0.25 |
| 0.48 | 0.39 | 0.15 | | | change score sds | percent change score sds | absolute values | 0.12 | 0.06 | 0.25 |
| -0.54 | 0.58 | 0.34 | | | change score sds | percent change score sds | absolute values | -0.11 | 0.06 | 0.25 |
| -3.54 | 1.64 | 2.69 | | | change score sds | percent change score sds | absolute values | -0.25 | 0.06 | 0.25 |
| -1.03 | 0.62 | 0.38 | | | change score sds | percent change score sds | absolute values | -0.18 | 0.06 | 0.25 |
| 0.06 | 0.54 | 0.29 | | | change score sds | percent change score sds | absolute values | 0.02 | 0.06 | 0.25 |
| -0.14 | 0.98 | 0.96 | | | change score sds | percent change score sds | absolute values | 0.00 | 0.06 | 0.25 |
| 0.38 | 0.78 | 0.61 | | | change score sds | percent change score sds | absolute values | 0.04 | 0.06 | 0.25 |
| -2.56 | | | | | change score sds | | absolute values | -0.47 | 0.29 | 0.53 |
| -3.00 | | | | | change score sds | | absolute values | -0.50 | 0.29 | 0.53 |
| 1.28 | | | | | change score sds | | absolute values | 0.18 | 0.28 | 0.53 |
| 19.31 | | | | | change score sds | | absolute values | 0.63 | 0.29 | 0.54 |
| -10.20 | | | | | change score sds | | absolute values | -0.45 | 0.28 | 0.53 |

Outcome Characteristics

| es_direction | notes_oc |
|---|---|
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| negative | |
| negative | no final data provided |
| negative | no final data provided |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| negative | |
| negative | no final data provided |
| negative | no final data provided |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| positive | included exercise leg of control group versus control leg of exercise group in analysis |
| negative | |
| negative | no final data provided |
| negative | no final data provided |
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Outcome Characteristics

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| positive | |
| positive | |
| negative | no final data provided |
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| positive | |
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| positive | |
| negative | no final data provided |
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| positive | |
| positive | g calculated from p-value |
| positive | |
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Outcome Characteristics

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| negative | no final data provided |
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| negative | no final data provided |
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Outcome Characteristics

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| negative | no final data provided |
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| negative | no final data provided |
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| negative | no final data provided |
| negative | no final data provided |
| positive | no final data provided |
| negative | no final data provided |
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| negative | |

Outcome Characteristics

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| negative | |
| positive | no final data provided |
| positive | |
| positive | |
| positive | |
| negative | |
| negative | |
| positive | no final data provided |
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| positive | no final data provided |
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| negative | |
| positive | |
| positive | |
| positive | |
| positive | |
| negative | no final data provided |
| negative | no final data provided |
| negative | no final data provided |
| positive | no final data provided |
| positive | |

Outcome Characteristics

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| positive | |
| positive | |
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| positive | no final data provided |
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Outcome Characteristics

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| positive | |
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| positive | no final data provided |
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| positive | no final data provided |
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| negative | no final data provided |
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| negative | no final data provided |
| negative | no final data provided |
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Outcome Characteristics

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| negative | |
| negative | no final data provided |
| positive | no final data provided |
| negative | no final data provided |
| positive | no final data provided |
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| positive | no data for control group |
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| negative | no final data provided |
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Outcome Characteristics

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| positive | no data for control group |
| positive | no data for control group |
| positive | no data for control group |
| negative | no final data provided |
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| negative | no final data provided |
| negative | no final data provided |
| positive | no final data provided |
| positive | no final data provided |
| positive | reported data as itt analysis but provided data as abp |
| positive | reported data as itt analysis but provided data as abp |
| positive | reported data as itt analysis but provided data as abp |
| negative | no final data provided |
| negative | no final data provided |
| positive | no final data provided |
| positive | no final data provided |
| positive | reported data as itt analysis but provided data as abp |
| positive | reported data as itt analysis but provided data as abp |

Outcome Characteristics

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| positive | reported data as itt analysis but provided data as abp |
| negative | no final data provided |
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| positive | no final data provided |
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| negative | no final data provided |
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Outcome Characteristics

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| negative | no final data provided |
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| negative | no final data provided |

Outcome Characteristics

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| positive | no final data provided |
| positive | no final data provided |
| positive | no final data provided |
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| positive | no final data provided |
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Outcome Characteristics

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| negative | no final data provided |
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| negative | no final data provided |
| negative | no final data provided |
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| negative | no final data provided |
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Outcome Characteristics

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| negative | no final data provided |
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| negative | no final data provided |
| positive | no final data provided |
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Outcome Characteristics

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| negative | |
| negative | |
| positive | |
| positive | adjusted for baseline height and weight |
| positive | adjusted for baseline height and weight |
| positive | adjusted for baseline height and weight |
| positive | adjusted for baseline height and weight |
| positive | g calculated from p-value |
| positive | g calculated from p-value |
| positive | g calculated from p-value |
| positive | |
| positive | |
| positive | |
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| negative | no final data provided |
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| negative | no final data provided |
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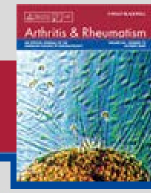
# APPENDIX D
# Published Abstracts of Presentations at Professional Conferences

Arthritis & Rheumatism AMERICAN COLLEGE OF RHEUMATOLOGY EDUCATION • TREATMENT • RESEARCH

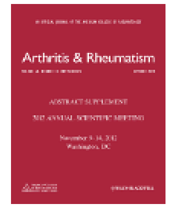


WILEY-BLACKWELL




# Arthritis & Rheumatism, Volume 64, November 2012 Abstract Supplement

Abstracts of the American College of Rheumatology/Association of Rheumatology Health Professionals Annual Scientific Meeting
Washington, DC November 9-14, 2012.



## Effects Of Ground And Joint Reaction Force Exercise On Bone Mineral Density In Postmenopausal Women: A Meta-Analysis Of Randomized Controlled Trials.

Kelley[1], George A., Kelley[1], Kristi S., Kohrt[2], Wendy M.

*West Virginia University, Morgantown, WV*
*University of Colorado @ Denver, Aurora, CO*


### Background/Purpose:

Previous randomized controlled trials have led to conflicting findings regarding the effects of ground and/or joint reaction force exercise on femoral neck (FN) and lumbar spine (LS) bone mineral density (BMD) in postmenopausal women. The purpose of this study was to use the aggregate data meta-analytic approach to resolve these discrepancies.

### Methods:

The *a priori* inclusion criteria were: (1) randomized controlled trials, (2) ground and/or joint reaction force exercise > 24 weeks, (3) comparative control group, (4) postmenopausal women, (5) participants not regularly active, (6) published and unpublished studies in any language since January 1, 1989, (7) BMD data available at the FN and/or LS. Studies were located by searching six electronic databases, cross-referencing, hand searching and expert review. Dual selection of studies and data abstraction were performed. Hedge's standardized effect size ($g$) was calculated for each FN and LS BMD result and pooled using random-effects models. $Z$-score alpha values, 95% confidence intervals (CI) and number-needed-to-treat (NNT) were calculated for pooled results. Heterogeneity was examined using Q and $I^2$. Mixed-effects ANOVA and simple meta-regression were used to examine changes in FN and LS BMD according to selected categorical and continuous variables. Statistical significance was set at an alpha value <= 0.05 and a trend at >0.05 to <= 0.10.

### Results:

Statistically significant exercise minus control group improvements were found for both FN (28 $g$'s, 1632 participants, $g$= 0.288, 95% CI = 0.102, 0.474, $p$= 0.002, Q = 90.5, $p$<0.0001, $I^2$= 70.1%, NNT = 6) and LS (28 $g$'s, 1504 participants, $g$= 0.179, 95% CI = -0.003, 0.361, $p$= 0.05, Q = 77.7, $p$<0.0001, $I^2$= 65.3%, NNT = 6) BMD. None of the mixed-effects ANOVA analyses were statistically significant. For both FN and LS BMD, statistically significant, or a trend for statistically significant and positive associations were observed for intensity of training and compliance (joint reaction force exercise only) as well as changes in static balance. Inverse associations were observed for compliance (combined ground and joint reaction force exercise) as well as changes in body mass index, body weight and percent body fat. When limited to the LS, statistically significant, or a trend for statistically significant and positive associations were found for age, years postmenopausal and changes in lean body

mass while inverse associations were observed for duration of training (minutes per session, ground reaction force exercise only), total minutes of training per week (ground reaction force exercise only), compliance (combined ground and joint reaction force exercise) and changes in aerobic fitness.

**Conclusion:**

Exercise benefits FN and LS BMD in postmenopausal women. Several of the observed associations appear worthy of further investigation in well-designed randomized controlled trials.

**To cite this abstract, please use the following information:**
**Kelley, George A., Kelley, Kristi S., Kohrt, Wendy M.; Effects of Ground and Joint Reaction Force Exercise On Bone Mineral Density in Postmenopausal Women: A Meta-Analysis of Randomized Controlled Trials. [abstract]. Arthritis Rheum 2012;64 Suppl 10 :2408**
**DOI: 10.1002/art.40139**

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AMERICAN COLLEGE of SPORTS MEDICINE
LEADING THE WAY

Presentation Abstract

| | |
|---|---|
| Session: | C-33-Exercise is Medicine - Implications for Body Composition |
| | Thursday, May 30, 2013, 7:30 AM -12:30 PM |
| Presentation: | 1206 - **Exercise and Bone Mineral Density in Premenopausal Women: A Meta-Analysis of Randomized Controlled Trials** |
| Location: | Hall C, Poster Board: 151 |
| Pres. Time: | Thursday, May 30, 2013, 8:00 AM - 9:30 AM |
| Category: | 1200. Exercise is Medicine – Focuses on the impact of physical activity on health and the prevention and treatment of disease and disability in clinical settings |
| Author(s): | George A. Kelley, FACSM[1], Kristi S. Kelley[1], Wendy M. Kohrt, FACSM[2]. [1]*West Virginia University, Morgantown, WV.* [2]*University of Colorado Denver, Aurora, CO.* |
| Abstract: | Maintaining optimal bone mineral density (BMD) during the premenopausal years is important for reducing the risk of osteoporosis and subsequent fractures during the postmenopausal years. Previous randomized controlled trials addressing the effects of joint and/or ground reaction force exercise on femoral neck (FN) and lumbar spine (LS) BMD in premenopausal women have led to conflicting and less than overwhelming results. **PURPOSE:** Examine the effects of exercise on FN and LS BMD in premenopausal women. **METHODS:** Meta-analysis of randomized controlled exercise trials $\geq$24 weeks in premenopausal women. Standardized effect sizes (*g*) were calculated for each result and pooled using random-effects models, Z-*score* alpha values, 95% confidence intervals (CI) and number-needed-to-treat (NNT). Heterogeneity was examined using Q and *I-squared*. Moderator and predictor analyses using mixed-effects ANOVA and simple meta-regression were conducted. Statistical significance was set at p $\leq$0.05. **RESULTS:** Statistically significant improvements were found for both FN (7 *g's*, 466 participants, *g*=0.342, 95% CI=0.132, 0.553, *p*=0.001, Q=10.8, *p*=0.22, *I-squared*=25.7%, NNT=5) and LS (6 *g's*, 402 participants, *g*=0.201, 95% CI=0.009, 0.394, *p*=0.04, Q=3.3, *p*=0.65, *I-squared*=0%, NNT=9) BMD. A trend for greater benefits in FN BMD was observed for studies published in countries other than the United States and for those who participated in home versus facility-based exercise. Statistically significant, or a trend for statistically significant, associations were observed for 7 different moderators and predictors, 6 for FN BMD and 1 for LS BMD. **CONCLUSIONS:** Exercise benefits FN and LS BMD in premenopausal women. The observed moderators and predictors deserve further investigation in well-designed randomized controlled trials. |

Disclosures: **G.A. Kelley:** None.

Print this Page

AMERICAN COLLEGE of SPORTS MEDICINE
LEADING THE WAY

Presentation Abstract

| | |
|---|---|
| Session: | D-33-Physical Activity Interventions/Promotion in Adults |
| | Thursday, May 30, 2013, 1:00 PM - 6:00 PM |
| Presentation: | 1599 - **Exercise and Bone Mineral Density in Men: A Meta-Analysis of Randomized Controlled Trials** |
| Location: | Hall C, Poster Board: 191 |
| Pres. Time: | Thursday, May 30, 2013, 3:30 PM - 5:00 PM |
| Category: | 5501. Physical Activity/Health Promotion Interventions - physical activity interventions |
| Keywords: | exercise; bone; meta-analysis |
| Author(s): | George A. Kelley, FACSM[1], Kristi S. Kelley[1], Wendy M. Kohrt, FACSM[2]. [1]*West Virginia University, Morgantown, WV.* [2]*University of Colorado Denver, Aurora, CO.* |
| Abstract: | Osteoporosis and osteopenia are major public health problems in men 50 years of age and older. Previous research regarding the effects of exercise on bone mineral density (BMD) in men has reached conflicting results. **PURPOSE:** Use the meta-analytic approach to examine the effects of ground and/or joint reaction force exercise on femoral neck (FN) and lumbar spine (LS) BMD in men. **METHODS:** Randomized controlled exercise trials $\geq$24 weeks were included. Standardized effect sizes (*g*) were calculated and pooled using random-effects models, Z-*score* alpha values and 95% confidence intervals (CI). Heterogeneity was examined using Q and *I-squared*. Statistical significance was set at a two-tailed alpha value (*p*) of $\leq$0.05 and a trend at >0.05 to $\leq$ 0.10. **RESULTS:** A moderate and statistically significant improvement was found at the FN (3 *g's*, 187 participants, *g*=0.583, 95% CI=0.031, 1.135, *p*=0.04, Q=5.6, *p*=0.06, *I-squared*=64%) while a small trend was observed at the LS (5 *g's*, 275 participants, *g*=0.190, 95% CI = -0.036, 0.416, *p*=0.10, Q=3.0, *p*=0.55, *I-squared*=0%). Results were sensitive to influence analysis as well as collapsing multiple groups from the same studies so that only one g represented each study. **CONCLUSIONS:** There is currently insufficient evidence to recommend ground and/or joint reaction force exercise for improving and/or maintaining FN and LS BMD in men. Additional well-designed randomized controlled trials are needed before any final recommendations can be formulated. |
| Disclosures: | **G.A. Kelley:** None. |

# APPENDIX E
# Publications in Peer-Reviewed Biomedical Journals

Kelley *et al. BMC Musculoskeletal Disorders* 2012, **13**:177
http://www.biomedcentral.com/1471-2474/13/177

BMC Musculoskeletal Disorders

RESEARCH ARTICLE Open Access

# Effects of ground and joint reaction force exercise on lumbar spine and femoral neck bone mineral density in postmenopausal women: a meta-analysis of randomized controlled trials

George A Kelley[1*], Kristi S Kelley[1] and Wendy M Kohrt[2]

## Abstract

**Background:** Low bone mineral density (BMD) and subsequent fractures are a major public health problem in postmenopausal women. The purpose of this study was to use the aggregate data meta-analytic approach to examine the effects of ground (for example, walking) and/or joint reaction (for example, strength training) exercise on femoral neck (FN) and lumbar spine (LS) BMD in postmenopausal women.

**Methods:** The *a priori* inclusion criteria were: (1) randomized controlled trials, (2) exercise intervention ≥ 24 weeks, (3) comparative control group, (4) postmenopausal women, (5) participants not regularly active, i.e., less than 150 minutes of moderate intensity (3.0 to 5.9 metabolic equivalents) weight bearing endurance activity per week, less than 75 minutes of vigorous intensity (> 6.0 metabolic equivalents) weight bearing endurance activity per week, resistance training < 2 times per week, (6) published and unpublished studies in any language since January 1, 1989, (7) BMD data available at the FN and/or LS. Studies were located by searching six electronic databases, cross-referencing, hand searching and expert review. Dual selection of studies and data abstraction were performed. Hedge's standardized effect size ($g$) was calculated for each FN and LS BMD result and pooled using random-effects models. *Z-score* alpha values, 95%confidence intervals (CI) and number-needed-to-treat (NNT) were calculated for pooled results. Heterogeneity was examined using Q and $I^2$. Mixed-effects ANOVA and simple meta-regression were used to examine changes in FN and LS BMD according to selected categorical and continuous variables. Statistical significance was set at an alpha value ≤0.05 and a trend at >0.05 to ≤ 0.10.

**Results:** Small, statistically significant exercise minus control group improvements were found for both FN (28 *g's*, 1632 participants, $g = 0.288$, 95% CI = 0.102, 0.474, $p = 0.002$, Q = 90.5, $p < 0.0001$, $I^2 = 70.1\%$, NNT = 6) and LS (28 *g's*, 1504 participants, $g = 0.179$, 95% CI = –0.003, 0.361, $p = 0.05$, Q = 77.7, $p < 0.0001$, $I^2 = 65.3\%$, NNT = 6) BMD. Clinically, it was estimated that the overall changes in FN and LS would reduce the 20-year relative risk of osteoporotic fracture at any site by approximately 11% and 10%, respectively. None of the mixed-effects ANOVA analyses were statistically significant. Statistically significant, or a trend for statistically significant, associations were observed for changes in FN and LS BMD and 20 different predictors.

**Conclusions:** The overall findings suggest that exercise may result in clinically relevant benefits to FN and LS BMD in postmenopausal women. Several of the observed associations appear worthy of further investigation in well-designed randomized controlled trials.

**Keywords:** Exercise, Bone, Osteoporosis, Women, Postmenopausal, Aging, Meta-analysis, Systematic review

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Full list of author information is available at the end of the article

## Background

Osteoporosis is a major public health problem affecting an estimated 200 million women worldwide [1]. Congruent with osteoporosis is an increased risk for osteoporosis-related fractures, especially in women during the postmenopausal years, generally considered to begin around 50 years of age [2]. Comparatively, the lifetime risk of an osteoporosis-related fracture in women is equivalent to the risk of developing cardiovascular disease [3]. The two most common sites for osteoporosis-related fractures are the hip and the spine, with an estimated worldwide prevalence of 1.1 million and 862,000, respectively, in women 50 years of age and older in the year 2000 [2]. In the United States, the total annual costs associated with osteoporosis-related fractures were more than $19 billion in 2005 with a predicted increase to $25.3 billion in 2025 [4]. The majority of the costs in 2005 were attributed to fractures of the hip (72%) followed by the spine (6%) [4].

Prevention of osteoporosis has focused on maximizing bone mineral density (BMD) during childhood and adolescence and maintaining BMD during adulthood [5,6]. Preventive measures include adequate calcium and vitamin D intake as well as avoiding cigarette smoking and excessive alcohol intake [5,6]. In addition, ground reaction (for example, jogging) and joint reaction (for example, strength training) force exercise has been recommended across the lifespan [5-8]. However, the results of previous randomized controlled exercise intervention trials have reached conflicting and underwhelming conclusions regarding the effects of ground reaction and/or joint reaction force exercise on BMD at the femoral neck (FN) and lumbar spine (LS) in postmenopausal women [9-33]. For example, using the vote-counting approach, only 29% of the exercise versus control group differences in FN BMD have been reported as statistically significant and in the direction of benefit while even fewer (11%) have been reported at the LS [9-33]. Based on these findings, one might reach the general conclusion that ground and joint reaction force exercise have little or no effect on FN and LS BMD. However, reliance on a vote-counting approach based on statistical significance can be extremely misleading since the absence of a statistically significant effect does not mean that an effect is absent [34]. In contrast, meta-analysis allows one to go beyond statistical significance and focus on the magnitude of effect. It is a quantitative approach for combining the results of studies. The strengths of meta-analysis include: (1) increased power, (2) improved estimates of effect size (ES), and (3) the potential to resolve disagreements between studies [35].

While a number of meta-analyses have been conducted on the effects of exercise on FN and LS BMD in adults [36-54], fewer have focused, or partitioned data, according to randomized controlled trials in postmenopausal women [37,39,48-51,53]. One meta-analysis that included studies published up to December, 1995 found a statistically significant exercise minus control group benefit of 0.73% in LS BMD as a result of joint and/or ground reaction force exercise in postmenopausal women [39]. Another meta-analysis that included studies published up to January, 1998 reported a statistically significant benefit in FN and LS BMD ranging from 0.9% to 1.6% as a result of impact and non-impact exercise among postmenopausal women [53]. However, both meta-analyses were limited to studies published more than 14 years ago. Since that time, additional randomized controlled trials with inconsistent findings have been published [10-12,14-17,19-22,24-27,30,32,33]. In addition, guidelines for the improved conduct of meta-analysis have been developed [47].

A modality-specific, joint reaction force meta-analysis that included studies published up to December 2004 found a statistically significant benefit of 0.006 g/cm$^2$ in LS BMD and a non-significant benefit of 0.010 g/cm$^2$ in FN BMD as a result of high-intensity resistance exercise in postmenopausal women [49]. Another modality-specific meta-analysis by the same research group which included studies published through December 2006 reported a non-statistically significant benefit in FN and LS BMD in postmenopausal women as a result of walking [50]. These findings suggest that walking, a lower impact, ground reaction force exercise, may have little benefit on FN and LS BMD in postmenopausal women. The same research group also published another meta-analysis that included studies published to 2008 [51]. When limited to randomized controlled trials and a random-effects model, a statistically significant benefit of 0.004 g/cm$^2$ was found for FN BMD with no statistically significant benefit observed at the LS as a result of exercise in postmenopausal women [51]. More recently, a Cochrane systematic review by Howe et al. reported a statistically significant exercise minus control group benefit of 0.85% in LS BMD but no significant change in FN BMD (−0.08%) as a result of joint and/or ground reaction force exercise in postmenopausal women [37]. However, this systematic review did not appear to be limited to studies in which participants had been previously participating in exercise levels below that currently recommended for bone health [8]. Consequently, the benefits of exercise could have been underestimated. Another meta-analysis reported a statistically significant benefit of 0.014 g/cm$^2$ and 0.012 g/cm$^2$, respectively, for both FN and LS BMD in females 60 years of age and older [48]. However, similar to the work of Howe et al. [37], participants did not appear to be limited to those who were participating in exercise levels below that currently recommended for bone health [8]. In addition, all studies were coded by one person, thereby increasing the risk for coding errors [47]. A potential reason for the

discrepancy in findings for FN BMD between the Howe et al. [37] and Marques et al. [48] reviews may be accounted for by the fact that the latter meta-analysis limited studies to those in adults 60 years of age and older. This raises the possibility that older postmenopausal women may have more to gain from a regular exercise program. Finally, because the number of analyses aimed at trying to establish the association between selected covariates and changes in FN and LS BMD was limited for all of the previously described meta-analyses, potentially important covariates could have been missed.

A need exists for an updated and thorough meta-analysis on the effects of different ground and joint reaction force exercises, either alone or in combination, on FN and LS BMD in postmenopausal women not participating in exercise levels currently recommended for bone health [8]. Therefore, the purpose of this study was to use the aggregate data meta-analytic approach to determine the effects of ground and/or joint reaction force exercise on BMD at the FN and LS in postmenopausal women not participating in exercise levels currently recommended for bone health [8].

## Methods

### Study eligibility criteria

The *a priori* inclusion criteria for this meta-analysis were as follows: (1) randomized controlled trials, (2) exercise intervention ≥ 24 weeks, (3) comparative control group (attention control, non-intervention, etc.), (4) postmenopausal women, as defined by the authors, (5) participants not currently participating in any type of regular joint and/or ground reaction force exercise, as defined by the authors, (6) published and unpublished (master's theses and dissertations) studies in any language since January 1, 1989 and (7) BMD (relative value of bone mineral per measured bone area or volume) assessed at the FN and/or LS using dual-energy x-ray absorptiometry (DEXA) or dual-photon absorptiometry (DPA). Given the heterogeneity of reporting by the authors with respect to previous exercise in participants, we revised our inclusion criteria *post hoc* so that only participants who performed less than 150 minutes of moderate intensity (3.0 to 5.9 metabolic equivalents) weight bearing endurance activity per week, less than 75 minutes of vigorous intensity (> 6.0 metabolic equivalents) weight bearing endurance activity per week, resistance training <2 times per week, were included [7]. Studies were limited to those in which exercise was performed for at least 6 months since it has been suggested that one can generally expect exercise-induced changes in BMD to occur after approximately this length of time [55]. Resistance training studies were included only if lower body exercises were part of the exercise program. The year 1989 was chosen as the starting point for the inclusion of studies because it appeared to be the first year in which a randomized controlled intervention trial on exercise and BMD in postmenopausal women was conducted [56]. Studies were limited to those in which BMD at the FN and LS were assessed using either DPA or DEXA since they are/have been the most common instruments for assessing BMD in the clinical setting. Only those groups that met the inclusion criteria were included from each study. Any studies not meeting all of the above criteria were excluded from the meta-analysis.

### Data sources

Studies were retrieved using the following six electronic databases: (1) Medline (within EBSCO host), (2) Embase, (3) Cochrane Central Register of Controlled Trials (CENTRAL), (4) Dissertation Abstracts Online (DAO), (5) CINAHL (within EBSCOhost), and (6) SPORTDiscus (within EBSCOhost). The last search was conducted in August, 2011. All electronic searches were conducted by the second author with assistance from a Health Sciences librarian at West Virginia University. While the search strategies used varied according to the different databases searched, three key words, or forms of keywords, germane to all searches were 'exercise', 'bone' and 'randomized'. An example of the search strategy used for one of the electronic database searches (SPORTDiscus) is shown in Additional file 1. In addition to electronic searches, cross-referencing from retrieved studies and previous review articles, both systematic and narrative, was performed. Furthermore, hand searches of selected journals were conducted.

### Study selection

All studies were selected by the first two authors, independent of each other. Disagreements regarding the final list of studies to include were resolved by consensus. If consensus could not be reached, the third author acted as an arbitrator. After an initial list of included studies was developed, the third author reviewed the list for completeness. All included studies as well as a list of excluded studies, including reasons for exclusion, were stored in Reference Manager (version 12.0.1) [57].

### Data abstraction

Prior to data abstraction, a detailed codebook that could hold more than 245 items per study was developed by all three members of the research team in Microsoft Excel 2007 [58]. The major categories of variables that were coded included: (1) study characteristics, (2) subject characteristics, (3) exercise program characteristics, (4) primary outcomes and (5) secondary outcomes. The primary outcomes for this study were BMD at the FN and LS. Secondary outcomes included other measures of BMD (Ward's triangle, total hip, trochanteric, intertrochanteric, whole body, radius) as well as number of

fractures, aerobic fitness, dynamic and static balance, body weight, body mass index (BMI), lean body mass (LBM), fat mass, percent body fat, upper and lower body muscular strength, and calcium and vitamin D intake. Missing primary outcome data were requested from the author(s). Multiple publication bias was avoided by only including data from the most recently published study.

As part of the coding process, the effective load rating for the exercise intervention from each study was calculated using a recently developed, age-adjusted formula [59]. This included the frequency of exercise per week along with the effective load rating, calculated as the product of peak vertical ground reaction force and the rate of force application [59]. Given the multiple types of exercises used in many of the studies, it was not possible to calculate effective load ratings specific to each activity within each study. Therefore, the broad categories recommended by previous work were used [59]. These included numerical effective load ratings equivalent to low (walking, etc.), moderate (tennis, etc.) and high (jumping, etc.) forces [59]. Effective load ratings were also provided for strength training [59]. All studies were coded by the first two authors, independent of each other. They then met and reviewed every entry for accuracy and consistency. Discrepancies were resolved by consensus. If consensus could not be reached, the third author served as an arbitrator.

## Risk of bias

The Cochrane Collaboration risk of bias instrument was used to assess bias across five categories: (1) sequence generation, (2) allocation concealment, (3) blinding to group assignment, (4) incomplete outcome data and (5) incomplete outcome reporting [60]. Each item was classified as having either a high, low, or unclear risk of bias [60]. Assessment for risk of bias was limited to the primary outcomes of interest, i.e. FN and LS BMD. Given the objective nature of BMD assessment, all studies were considered to be at a low risk of bias with respect to blinding unless the study reported some reason for such. For incomplete outcome reporting, studies were considered to be at an unclear risk for bias if studies did not report a study protocol identification number to confirm assessed outcomes. No study was excluded based on the results of the risk of bias assessment [61]. All assessments were performed by the first two authors, independent of each other. Both authors then met and reviewed every item for agreement. Disagreements were resolved by consensus.

## Statistical analysis

### *Calculation of effect sizes for primary and secondary outcomes from each study*

Given the different methods of reporting results for primary outcomes, i.e., FN and LS BMD, the standardized mean difference effect size ($g$), adjusted for small sample bias, was calculated from each study in order to create a common metric for the pooling of findings [62]. Since all studies were parallel, randomized controlled trials [9-33], the $g$ for each outcome from each study was calculated as the difference in change scores between the exercise and control groups divided by the pooled SD of the change scores [62]. For studies in which change outcome SDs for the exercise and control groups were not reported, these were estimated for the exercise and control groups using pre-and post-intervention means and SDs according to the approach of Follmann et al. [63]. For studies that did not allow for such calculations using the aforementioned methods, $g$ was calculated using the reported 95% confidence intervals (95% CIs). After calculating $g$ from each study, its variance was estimated using previously developed procedures [62]. The beneficial effects of exercise on FN and LS BMD were denoted by a positive $g$.

Secondary outcomes from each study were calculated using either $g$ (Ward's triangle, total hip, trochanteric, whole body, radius, calcaneus, aerobic fitness, dynamic and static balance, upper and lower body muscular strength) or the original metric (body weight in kilograms, BMI in kilogram per meters-squared, LBM in kilograms, fat mass in kilograms and percent of body weight, calcium intake in milligrams, vitamin D intake in micrograms).

### *Pooled estimates for FN and LS BMD*

Random-effects, method-of-moments models that incorporate heterogeneity into the overall estimate were used to pool results for FN and LS BMD as well as secondary outcomes from each study [64]. Multiple groups from the same study were analyzed independently as well as collapsing multiple groups so that only one ES represented each outcome from each study. For the one study that included both per-protocol and intention-to-treat analyses, the more conservative intention-to-treat results were used [10]. While the same study assessed LS BMD at both the L1-L4 and L2-L4 sites [10], data are reported using the L1-L4 sites based on the International Society for Clinical Densitometry 2007 Position Stand recommending that L1-L4 be used for LS BMD measurement [65]. A *z-score* two-tailed alpha value of $\leq 0.05$ was considered to be statistically significant. Alpha values $>0.05$ but $\leq 0.10$ were considered as a trend. To determine the precision of these estimates, two-tailed 95% confidence intervals (CIs) were also calculated. Analysis of secondary outcomes was considered exploratory because they were not part of the inclusion criteria, and thus, may represent a biased sample.

In terms of magnitude, values for those outcomes in which $g$ was used may be classified as either trivial ($<0.20$), small ($\geq 0.20$ to $<0.50$), medium ($\geq 0.50$ to $<0.80$), or large ($\geq 0.80$) [66]. A $g$ of 0.20, for example, means that exercise

would result in a 0.20 SD benefit over those who did not exercise. Given that the interpretation of *g* can be difficult with respect to clinical and practical relevance [67], the number needed to treat (NNT) was estimated for FN and LS BMD from pooled *g's* using procedures described by Kraemer and Kupfer [68]. For continuous data, the event is the increase in BMD of magnitude *g*. In addition, the NNT was used to provide a gross estimate of the number of US women 50 years of age and older who could achieve benefit in FN and LS BMD by initiating and maintaining a regular exercise program. This estimate was based on US Census Data for the number of women 50 years of age and older in the US (53,410,602) [69] and Healthy People 2020 Objective PA-2.4 for increasing by 10% the number of adults who meet current physical activity guidelines for aerobic and muscle-strengthening activity [70]. Based on the most recently available physical activity estimates for US adult females, this means an increase in physical activity from 14.9% to approximately 16.4%, a 1.49% increase [71].

### Stability and validity of changes in g for FN and LS BMD

Heterogeneity of results between studies was examined using Q as well as an extension of the Q statistic, $I^2$ [72]. Statistical significance for Q was set at an alpha value of ≤0.10. For $I^2$ values of 25% to <50%, 50% to <75%, and ≥75% may be considered to represent small, medium, and large amounts of inconsistency, respectively [72]. To determine treatment effects in a new trial, 95% prediction intervals were also calculated [73,74].

Publication bias was examined using the trim and fill approach of Duval and Tweedie [75]. Potential publication bias was considered noteworthy if a statistically significant finding was no longer significant after imputing potentially missing studies.

In order to examine the effects of each g from each study on the overall findings, results were analyzed with each study deleted from the model once. In addition, standardized residuals ≥ 3.0 were considered as outliers but not arbitrarily deleted from the model. Cumulative meta-analysis, ranked by year, was used to examine the accumulation of evidence over time on FN and LS BMD [76].

### Moderator analysis for FN and LS BMD

Between-group differences ($Q_b$) in FN and LS BMD for categorical variables were examined using mixed effects ANOVA-like models for meta-analysis [77]. This consisted of a random effects model for combining studies within each subgroup and a fixed effect-model across subgroups [77]. Study-to-study variance (tau-squared) was considered not equal for all subgroups. This value was computed within subgroups but not pooled across subgroups. Planned categorical variables to examine *a priori* and in which each category had at least 3 *g's* included: country in which the study was conducted (USA, other), type of control group (non-intervention, other), matching procedures (yes, no), risk of bias assessment (sequence generation, allocation concealment, blinding, incomplete outcome data, outcome reporting bias according to low, high or unclear risk), type of analysis (per-protocol, intention-to-treat), provision of sample size estimates (yes, no), external funding for the study (yes, no), adverse events (yes, no), whether participants were allowed or required to have osteoporosis, whether they were allowed to be current cigarette smokers and/or consume alcohol (yes, no), changes in exercise habits beyond the exercise intervention (increase, decrease, no change), no prior exercise allowed versus some prior exercise but less than that recommended by the American College of Sports Medicine (yes, no) [8], whether calcium and/or vitamin D supplements were given during the study (yes, no), type of exercise (aerobic, strength, both), exercise delivery (supervised, unsupervised, both), type of reaction forces (ground, joint, both) and instrumentation (Hologic, Lunar). The two-tailed alpha value for a statistically significant difference between groups ($Q_b$) was set at $p \leq 0.05$ with values >0.05 but ≤0.10 considered as a trend. All moderator analyses were considered exploratory [78].

### Meta-regression for FN and LS BMD

Simple mixed-effects, method of moments meta-regression was used to examine the potential association between changes in FN and LS BMD and continuous variables with at least 3 *g's* [77]. Because of expected missing data for different variables from different studies, only simple meta-regression was planned and performed. Potential predictor variables, established *a priori,* included year of publication, percentage of dropouts, age in years and years postmenopausal. For exercise training, variables for aerobic-only groups included length (weeks), frequency (days per week), intensity, expressed as a percentage of maximum oxygen consumption (%$VO_{2max}$), percentage of maximal heart rate (MHR) or heart rate reserve (HRR), duration (minutes per session), minutes of training per week and compliance, defined as the percentage of exercise sessions attended. For strength training only groups, variables included: length (weeks), frequency (days per week), intensity, expressed as a percentage of one-repetition maximum (% 1RM), number of sets, repetitions and exercises, rest between sets (seconds) and compliance (%). For those groups that performed both aerobic and strength training concurrently, variables included: length in weeks, frequency (days per week) and percent compliance. Other potential predictors included: load ratings and baseline BMD as well as changes in aerobic fitness, dynamic and static balance, calcium and vitamin D intake, lower and upper body strength, BMI in $kg/m^2$,

body weight, LBM, percent body fat and fat mass. The alpha value for a statistically significant association was set at ≤0.05. Alpha values >0.05 but ≤0.10 were considered as a trend for an association. All meta-regression analyses were considered exploratory [78].

## Results

### Study characteristics

A general description of the characteristics of each study is shown in Additional file 2. Of the 1,182 citations reviewed, 25 studies representing 63 groups (35 exercise, 28 control) and final assessment of FN and/or LS BMD in 1775 participants, were included [9-33]. One study's initial exercise inclusion criteria exceeded the exercise eligibility criteria for the current meta-analysis [23]. However, a decision was made to include this study because it was apparent upon further reading that the exercise levels of the participants met the eligibility criteria for the current meta-analysis [23]. Missing primary outcome data were successfully retrieved from three studies [10-12]. The number of exercise participants assessed was 991 while the number of controls assessed was 826. The total (1817) exceeds 1775 because one study had participants exercise one side of the body while the other side served as a control [23]. A description of the search process, including the reasons for excluded studies, is shown in Figure 1. The number of intervention and control groups exceeded the number of studies because some studies included more than one intervention and/or control group that met the inclusion criteria for the current meta-analysis. All studies were published in the English language between the years 1992 and 2011 [9-33]. Twenty-four (96%) were published in journals [9-18,20-33] while one was a dissertation [19]. With respect to country in which the study was conducted, six were performed in the United States [17,18,21,28-30], three in Australia [23,24,31], four in Canada [14,15,25,32], two each in either Brazil [11,12], Japan [20,33], Portugal [26,27], Sweden [10,16], or the United Kingdom [9,13], and one each in China [19] and Germany [22], For types of controls, 11 studies (44%) used a non-intervention control group [9,11,12,16-19,26,27,29,32], while 14 others (56%) used a variety of comparative controls [10,13-15,20-25,28,30,31,33]. Seven of 25 studies (28%) [12,16-19,22,25] reported using the following matching procedures: (1) age [16,22], (2) use of menopausal hormone therapy [12,17], (3) gender [19], (4) BMD and bodyweight [18], (5) postural stability, baseline BMD at the total hip and bisphosphonate use [25]. None of the studies reported using a crossover design. For sample size justification, 12 studies (48%) reported data regarding such [9,10,12,14,16,19,21,22,25-27,30]. Nineteen studies (76%) reported receiving some type of external funding to conduct their study [9,13-17,19,21-31,33].

The dropout rate ranged from 0% to 43% for the 30 exercise groups for which data were available ($\bar{x} \pm SD =$ $17 \pm 12\%$, Mdn = 12%) and 0% to 27% for the 24 control groups in which data were available for ($\bar{x} \pm SD = 13 \pm 7\%$, Mdn = 15%). Twelve studies (52%) provided one or more of the following reasons for participants dropping out or for the investigative team to drop participants from the study: (1) personal health problems apparently unrelated to the intervention [13,16,17,26,27,29,30,33], (2) time [14,25,30], (3) lack of compliance to the exercise intervention [10,11], (4) personal issues not related to one's health [11,13,26,27,33], (5) lack of interest [26] and (6) moved [30]. Five studies (20%) reported that one or more participants experienced musculoskeletal pain and/or minor musculoskeletal injuries as a result of the exercise intervention [9,18,24,29,30]. For the other studies, a lack of complete data were available regarding any possible pain and/or injuries as a result of the interventions. No serious adverse events were reported.

Initial physical characteristics of the participants are shown in Table 1. Fourteen studies (56%) reported data on race/ethnicity with the majority of participants consisting of either whites [14,15,18,21,22,25-30] or Asians [19,20,33]. For medication usage, two studies (8%) included groups in which all participants were taking menopausal hormone therapy [9,17] while four studies (16%) reported that some participants in their groups were taking hormone therapy [12,18,25,30]. One study (4%) reported that some participants were taking bisphophonates [25] while none reported the use of glucocorticoids. With regards to osteoporosis, one study (4%) was limited to participants with osteoporosis [20] while three (12%) reported that some participants had osteoporosis [10,22,25]. Six studies (24%) reported that some participants had osteopenia [10,14,25-27,30]. Ten studies (40%) reported that some participants smoked cigarettes [9,10,13,19,22,25-28,30], while two (8%) reported that some consumed alcohol [15,30]. One study (4%) reported that participants in the exercise intervention group increased their physical exercise outside the intervention while the control group decreased their physical activity [29]. Ten studies (40%) reported giving calcium to participants [10,14,17,20-22,24,28,30,31] whereas another two (8%) provided calcium to some participants [9,29]. Vitamin D was reportedly provided to participants in six studies (24%) [10,14,20-22,28]. A total of three studies (12%) reported that one or more participants had previous fractures [10,25,29].

Characteristics of the exercise programs from each group and each study are described in Additional file 2. As can be seen, the exercise interventions varied widely. Fourteen groups (40%) participated in exercise interventions that focused on joint reaction forces (for example, strength training) while 12 (34%) focused on ground reaction forces

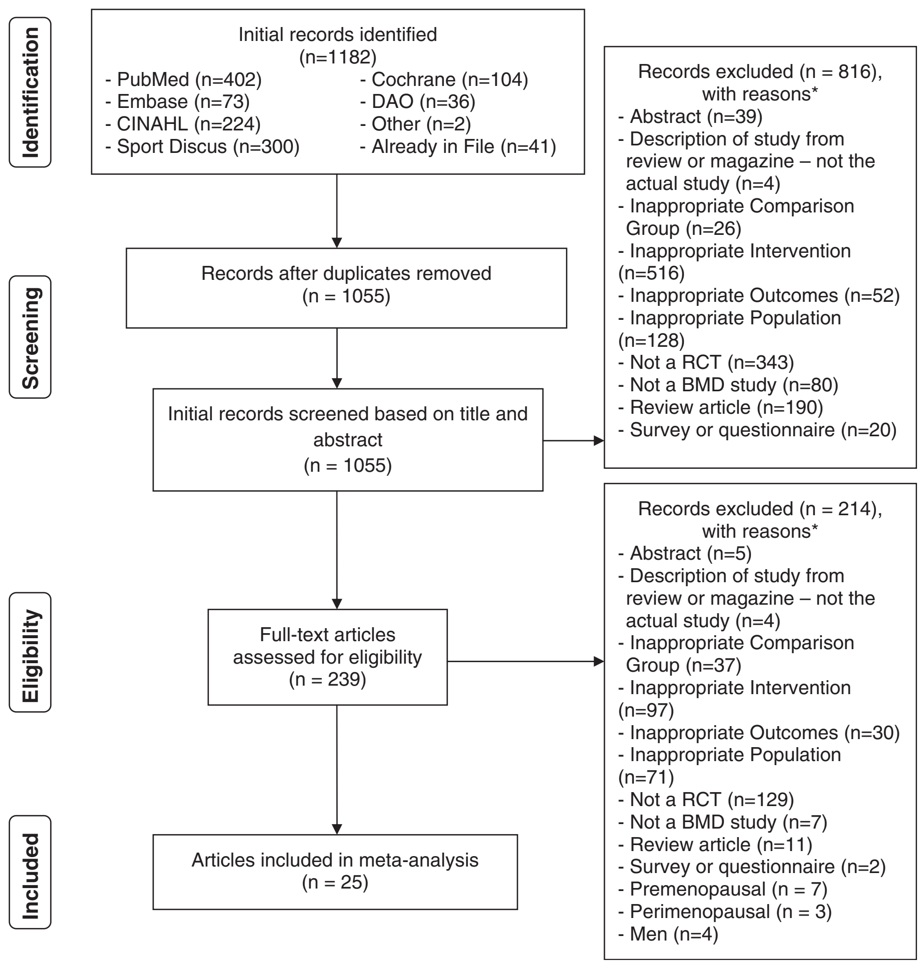


**Figure 1 Flow Diagram for the selection of studies.** *, number of reasons exceeds the number of studies because some studies were excluded for more than one reason.

(for example, aerobic exercises such as walking and jumping). Another nine groups (26%) included exercises that provided both joint and ground reaction forces. With the exception of four groups (11%) that performed either jumping or agility training, the remaining 31 (89%) focused on aerobic and/or strength training exercises. The load rating for the 28 groups in which data were available for calculation ranged from 9.4 to 340.5 ($\bar{x} \pm SD = 57.3 \pm 117.7$, Mdn = 10). The length of training across all groups ranged from 24 to 104 weeks ($\bar{x} \pm SD = 50.7 \pm 23.3$, Mdn = 52). A group summary of the characteristics for those studies that included aerobic and/or strength training is shown in Table 2.

Bone mineral density assessment information is shown in Additional file 2. With the exception of two earlier studies that used dual photon absorptiometry [18,28], all others used dual-energy x-ray absorptiometry to assess BMD at the FN and LS [9-17,19-27,29-33]. The two most common instruments used to assess FN and LS BMD were Hologic (48%) and Lunar (40%). For those studies that provided data [9,13,14,16,20,22-27,30,32], coefficients of variation for the assessment of BMD ranged from 0.8% to 1.9% and 0.6% to 1.5%, respectively, for FN and LS BMD.

## Risk of bias assessment

Risk of bias results are shown in Figure 2. As can be seen, the majority of studies were considered to be at low risk with respect to sequence generation and blinding and unclear risk for allocation concealment and incomplete outcome reporting. Approximately half of the studies were considered to be at either low or unclear risk for incomplete outcome data.

## Primary outcomes

### *FN BMD*

Overall, there was a statistically significant benefit of ground and/or joint reaction force exercise on FN BMD (Table 3, Figure 3). In addition, non-overlapping CIs were observed. The NNT was 6 with an estimated 127,968 postmenopausal US women experiencing

**Table 1 Initial physical characteristics of participants**

| | Exercise | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | Groups (#) | x̄±SD | Mdn | Range | Groups (#) | x̄±SD | Mdn | Range |
| Age (yrs) | 33 | 62.9 ± 7.3 | 60 | 54 - 80 | 27 | 62.2 ± 6.7 | 60 | 53 – 80 |
| Height (cm) | 22 | 161.5 ± 3.3 | 162 | 152 - 165 | 19 | 161.4 ± 3.2 | 162 | 152 – 165 |
| Postmenopausal (yrs) | 26 | 13.8 ± 8 | 11 | 3 - 30 | 21 | 12.9 ± 7.1 | 10 | 4 – 30 |
| Body weight (kg) | 28 | 66.4 ± 6.6 | 68 | 46 – 78 | 23 | 67.2 ± 7.9 | 68 | 46 – 84 |
| Body mass index (kg/m$^2$) | 21 | 25.6 ± 2.2 | 26 | 20 - 29 | 18 | 25.6 ± 2.6 | 26 | 20 – 31 |
| Lean body mass (kg) | 18 | 39.2 ± 2.2 | 39 | 35 - 43 | 13 | 39.1 ± 1.9 | 39 | 35 – 42 |
| Fat mass (kg) | 6 | 22.1 ± 5.3 | 21 | 17 - 32 | 4 | 24.0 ± 8.5 | 23 | 15 – 35 |
| Body fat (%) | 15 | 39.3 ± 3.2 | 39 | 31 – 44 | 12 | 39.1 ± 3.5 | 39 | 31 – 46 |
| Calcium intake (mg) | 12 | 846 ± 179 | 832 | 609 – 1214 | 10 | 868 ± 213 | 829 | 626 - 1190 |
| Vitamin D (mcg) | 5 | 5.6 ± 5.1 | 2 | 2 - 12 | 4 | 5.3 ± 3.9 | 5 | 2 – 9 |
| BMD (g/cm$^2$) | | | | | | | | |
| - Femoral neck | 27 | 0.749 ± 0.094 | 0.720 | 0.580 – 0.925 | 24 | 0.766 ± 0.095 | 0.770 | 0.590 – 0.927 |
| - Lumbar spine | 28 | 0.957 ± 0.158 | 0.966 | 0.595 – 1.180 | 24 | 1.00 ± 0.100 | 1.00 | 0.600 – 1.200 |
| - Ward's triangle | 8 | 0.591 ± 0.089 | 0.575 | 0.441 – 0.730 | 6 | 0.605 ± 0.097 | 0.598 | 0.474 – 0.760 |
| - Total hip | 13 | 0.802 ± 0.093 | 0.840 | 0.670 – 0.940 | 11 | 0.843 ± 0.092 | 0.869 | 0.690 – 1.00 |
| - Trochanteric | 20 | 0.659 ± 0.085 | 0.650 | 0.510 – 0.806 | 16 | 0.682 ± 0.085 | 0.685 | 0.520 – 0.840 |
| - Intertrochanteric | 11 | 0.959 ± 0.076 | 0.986 | 0.820 – 1.035 | 7 | 0.979 ± 0.068 | 0.990 | 0.850 – 1.00 |
| - Whole body | 8 | 1.033 ± 0.073 | 0.99 | 0.970 – 1.130 | 7 | 1.043 ± 0.070 | 1.002 | 0.980 – 1.130 |
| - Radius - 1/3 | 4 | 0.600 ± 0.028 | 0.610 | 0.560 – 0.620 | 3 | 0.603 ± 0.012 | 0.610 | 0.590 – 0.610 |
| - Radius – mid | 4 | 0.523 ± 0.015 | 0.530 | 0.500 – 0.530 | 3 | 0.520 ± 0.017 | 0.530 | 0.500 – 0.530 |
| - Radius – ultradistal | 4 | 0.363 ± 0.005 | 0.360 | 0.360 – 0.370 | 3 | 0.363 ± 0.006 | 0.360 | 0.360 – 0.370 |

Notes: Groups (#), number of groups in which data were available; x̄±SD, mean ± standard deviation; Mdn, Median; BMD, bone mineral density; Baseline data for aerobic fitness, balance and muscular strength not reported because of the different metrics used in the studies.

benefit in FN BMD if they began and maintained a regular exercise program. A moderate but statistically significant amount of heterogeneity was observed as well as overlapping prediction intervals. No adjustment for publication bias was needed. With each study deleted from the model once, results remained statistically significant across all deletions (Figure 4). The difference in *g* between the largest and smallest values with each

**Table 2 Training program characteristics for aerobic, strength and aerobic + strength training interventions**

| | Aerobic | | | | Strength | | | | Aerobic + Strength | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Groups (#) | x̄±SD | Mdn | Range | Groups (#) | x̄±SD | Mdn | Range | Groups (#) | x̄±SD | Mdn | Range |
| Length (weeks) | 9 | 52 ± 22 | 52 | 24-104 | 14 | 46 ± 21 | 52 | 24-104 | 10 | 58 ± 29 | 52 | 24-104 |
| Frequency (days/week) | 8 | 3 ± 1 | 3 | 3-4 | 14 | 3 ± 1 | 3 | 3-6 | 9 | 3 ± 1 | 3 | 2-7 |
| Intensity* | 4 | 55 ± 14 | 59 | 36-68 | 6 | 63 ± 26 | 73 | 15-85 | - | - | - | - |
| Duration (min/sessions) | 6 | 34 ± 12 | 38 | 10-30 | - | - | - | - | - | - | - | - |
| Minutes (per week) | 6 | 103 ± 37 | 113 | 60-135 | - | - | - | - | - | - | - | - |
| Minutes (per week adjusted) | 5 | 79 ± 33 | 71 | 48-113 | - | - | - | - | - | - | - | - |
| Sets (#) | NA | NA | NA | NA | 12 | 3 ± 1 | 3 | 1-5 | 5 | 2 ± 0.4 | 2 | 2-3 |
| Repetitions (#) | NA | NA | NA | NA | 9 | 12 ± 8 | 10 | 8-30 | - | - | - | - |
| Rest between sets (sec.) | NA | NA | NA | NA | 4 | 75 ± 57 | 90 | 0-120 | - | - | - | - |
| Exercises (#) | NA | NA | NA | NA | 14 | 8 ± 4 | 9 | 1-12 | 5 | 8 ± 3 | 7 | 4-12 |
| Compliance (%) | 7 | 75 ± 16 | 80 | 39-84 | 10 | 83 ± 5 | 85 | 74-90 | 7 | 76 ± 11 | 77 | 59-95 |

Groups (#), number of groups in which data were available; x̄±SD, mean ± standard deviation; Mdn, Median; *, intensity expressed as a percentage of maximum oxygen consumption for aerobic groups and percentage of one-repetition maximum for strength training groups; -, insufficient data to calculate; NA, not applicable.

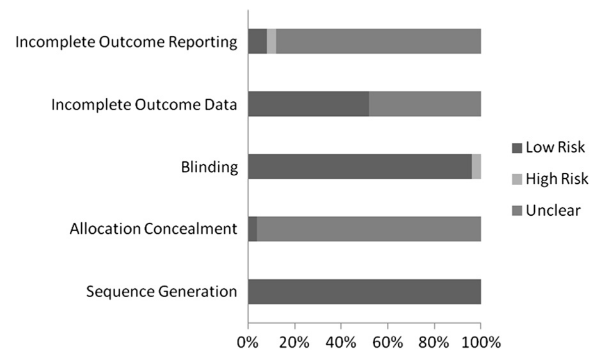


**Figure 2 Risk of bias.** Pooled risk of bias results using the Cochrane Risk of Bias Assessment Tool [60].

study deleted from the model was 0.081 (26.0%). With two outliers removed [11,21], results remained statistically significant ($g = 0.207$, 95% CI = 0.076, 0.338, $p = 0.002$) and heterogeneity, while statistically significant (Q = 42.2, $p = 0.02$), was reduced to 40.7%. Improvements in FN BMD also remained statistically significant when data were collapsed so that only one $g$ represented each study ($g = 0.343$, 95% CI = 0.129, 0.556, $p = 0.002$, Q = 85.5, $p < 0.0001$, $I^2 = 76.6\%$). Cumulative meta-analysis, ranked by year, demonstrated that results have been statistically significant, or there has been a trend for statistical significance, since 2000 (Figure 5).

Moderator analysis for changes in FN BMD is shown in Additional file 3. As can be seen, no statistically significant between-group differences ($Q_b$) were found for those *a priori* comparisons for which sufficient data were available.

Meta-regression analyses for changes in FN BMD are shown in Additional file 4. As can be seen, there was a statistically significant association between increases in FN BMD and decreased compliance (combined aerobic and strength training groups only), decreases in BMI, decreases in body weight and decreases in percent body fat. A trend for a statistically significant association was observed for increases in FN BMD and increases in

**Table 3 Changes in primary and secondary outcomes**

| Variable[a] | Studies (#) | ES (#) | Participants (#) | $\bar{x}$(95% CI) | Z(p) | Q(p) | $I^2$ (%) | 95% PI |
|---|---|---|---|---|---|---|---|---|
| Primary | | | | | | | | |
| - Femoral neck | 21 | 28 | 1632 | 0.288 (0.102, 0.474) | 3.03(0.002)* | 90.5(p <0.0001)* | 70.1 | −0.568, 1.142 |
| - Lumbar spine | 21 | 28 | 1504 | 0.179 (−0.003, 0.361) | 1.93(0.05)* | 77.7(<0.0001)* | 65.3 | −0.614, 0.972 |
| Secondary | | | | | | | | |
| - Ward's triangle | 6 | 8 | 252 | 0.260 (−0.405, 0.613) | 0.40(0.69) | 28.1(<0.0001)* | 75.1 | −1.567, 1.775 |
| - Total hip | 10 | 14 | 734 | 0.232 (0.073, 0.391) | 2.86(0.004)* | 17.6(0.18) | 26.0 | −0.149, 0.613 |
| - Trochanteric | 14 | 21 | 1085 | 0.222 (0.107, 0.337) | 3.79(<0.0001)* | 18.3(0.57) | 0 | 0.099, 0.345 |
| - Intetrochanteric | 6 | 10 | 399 | 0.241 (0.058, 0.425) | 2.58(0.01)* | 8.3(0.50) | 0 | 0.024, 0.458 |
| - Whole body | 6 | 7 | 246 | 0.121 (−0.055, 0.298) | 1.35(0.18) | 2.7(0.85) | 0 | −0.110, 0.352 |
| - Radius - 1/3 | 2 | 4 | 182 | 0.048 (−0.329, 0.424) | 0.25(0.81) | 5.8(0.12) | 48.2 | −1.365, 1.461 |
| - Radius – mid | 2 | 4 | 182 | 0.153 (−0.262, 0.568) | 0.72(0.47) | 7.0(0.07)** | 57.2 | −1.496, 1.802 |
| - Radius – ultradistal | 2 | 4 | 182 | 0.263 (−0.239, 0.765) | 1.03(0.31) | 10.1(0.02)* | 70.3 | −1.886, 2.412 |
| - Aerobic fitness | 5 | 8 | 198 | 1.146 (0.31, 1.930) | 2.86(0.004)* | 47.0(p <0.0001)* | 85.1 | −1.539, 3.831 |
| - Dynamic balance | 4 | 5 | 95 | 1.39 (0.766, 2.014) | 4.37(<0.0001)* | 18.9(0.001)* | 78.9 | −0.856, 3.636 |
| - Static balance | 5 | 7 | 112 | 0.841 (0.228, 1.454) | 2.69(0.007)* | 40.9(<0.0001)* | 85.3 | −1.254, 2.936 |
| - Body weight (kg) | 11 | 17 | 594 | −0.03 (−0.4, 0.4) | −0.15(0.88) | 13.0(0.67) | 0 | −0.5, 0.4 |
| - Body mass index (kg/m$^2$) | 8 | 11 | 511 | −0.2 (−0.8, 0.4) | −0.69(0.49) | 109.9(<0.0001)* | 90.9 | −2.3, 1.9 |
| - Lean body mass (kg) | 7 | 10 | 461 | 0.4 (−0.06, 0.9) | 1.72(0.09)** | 23.8(0.005)* | 62.1 | −1.0, 1.9 |
| - Fat mass (kg) | 4 | 6 | 230 | −0.5 (−1.2, 0.2) | −1.48(0.14) | 11.0(0.05)* | 54.6 | −2.4, 1.4 |
| - Body fat (%) | 5 | 7 | 211 | −1.7 (−2.8, -0.8) | −3.58(<0.0001)* | 13.1(0.04)* | 54.1 | −4.4, 0.8 |
| - Strength (upper body) | 7 | 9 | 300 | 2.01 (1.08, 2.95) | 4.24(<0.0001)* | 97.8(<0.0001)* | 97.8 | −1.33, 5.36 |
| - Strength (lower body) | 9 | 12 | 482 | 1.58 (0.91, 2.24) | 4.67(<0.0001)* | 120.9(<0.0001)* | 90.9 | −1.00, 4.10 |
| - Calcium intake (mg) | 5 | 7 | 319 | 10.1 (−15.8, 35.9) | 0.76(0.45) | 0.3(1.0) | 0 | −23.9, 44.0 |
| - Vitamin D (mcg) | – | – | – | – | – | – | – | – |

Notes: [a]Unless noted otherwise, all outcomes are reported as standardized effect size (g); ES, effect size; #, number; Z(*p*), *z*-score and alpha value; Q(*p*), Cochran's Q statistic and alpha value; $I^2$ *(%)*, I-squared; PI, prediction intervals. *, statistically significant ($p \le 0.05$; **trend for statistical significance ($p > 0.05$ to $\le 0.10$);
–, Insufficient data reported (< 3 ES's).

| Study name | Subgroup within study | Statistics for each study | | |
|---|---|---|---|---|
| | | Point estimate | Lower limit | Upper limit |
| Bassey et al., 1998 | hrt | 0.066 | -0.513 | 0.644 |
| Bassey et al., 1998 | no hrt | -0.311 | -0.767 | 0.145 |
| Bergstrom et al., 2008 | None | -0.112 | -0.485 | 0.261 |
| Bocalini et al., 2009 | None | 5.987 | 4.145 | 7.830 |
| Brentano et al., 2008 | circuit training | -0.642 | -1.565 | 0.282 |
| Brentano et al., 2008 | weight training | 0.137 | -0.788 | 1.062 |
| Brooke-Wavell et al., 1997 | None | 0.109 | -0.335 | 0.553 |
| Chilibeck et al., 2002 | None | 0.024 | -0.815 | 0.863 |
| Choquette et al., 2011 | None | 0.441 | -0.190 | 1.071 |
| Englund et al., 2005 | None | 0.000 | -0.621 | 0.621 |
| Going et al., 2003 | hrt | 0.171 | -0.166 | 0.509 |
| Going et al., 2003 | no hrt | 0.252 | -0.095 | 0.598 |
| Jessup et al., 2003 | None | 2.223 | 1.048 | 3.399 |
| Kemmler et al., 2010 | None | 0.648 | 0.381 | 0.915 |
| Kerr et al., 1996 | weight training (high load, low reps) | 0.142 | -0.437 | 0.721 |
| Kerr et al., 1996 | weight training (low load, high reps) | 0.318 | -0.322 | 0.958 |
| Kerr et al., 2001 | circuit training | 0.057 | -0.428 | 0.541 |
| Kerr et al., 2001 | weight training | 0.423 | -0.099 | 0.945 |
| Liu-Ambrose et al., 2004 | agility training | 0.263 | -0.229 | 0.755 |
| Liu-Ambrose et al., 2004 | weight training | -0.055 | -0.561 | 0.452 |
| Marques et al., 2011a | aerobic training | 0.123 | -0.443 | 0.690 |
| Marques et al., 2011a | weight training | -0.173 | -0.746 | 0.400 |
| Marques et al., 2011b | None | 0.727 | 0.204 | 1.249 |
| Nelson et al., 1994 | None | 0.713 | 0.065 | 1.360 |
| Newstead et al., 2004 | None | 0.271 | -0.293 | 0.834 |
| Prince et al., 1995 | None | 0.287 | -0.199 | 0.773 |
| Rhodes et al., 2000 | None | 1.213 | 0.521 | 1.906 |
| Wu et al., 2006 | None | 0.000 | -0.490 | 0.490 |
| | | 0.288 | 0.102 | 0.474 |

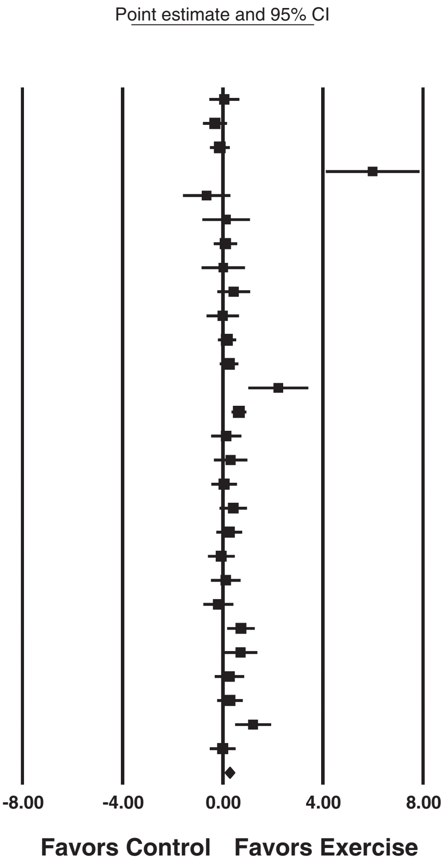


**Figure 3 Forest plot for changes in FN BMD.** Forest plot for point estimate standardized effect size changes (*g*) in FN BMD. The black squares represent the standardized mean difference (*g*) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (*g*) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. For subgroup, HRT means hormone replacement therapy.

intensity (strength only), increased compliance (strength training group only) and increases in static balance.

### *LS BMD*

Overall, there was a statistically significant benefit in LS BMD but slightly overlapping 95% CIs (Table 3, Figure 6). The NNT was 6 with an estimated 80,219 postmenopausal US women maintaining and/or increasing their LS BMD if they began and maintained a regular exercise program. A moderate and statistically significant amount of heterogeneity was observed as well as overlapping prediction intervals. No adjustment for publication bias was needed. With the exception of one study [11], an outlier, results remained statistically significant or there was a trend for statistical significance when each study was deleted from the model once (Figure 7). The difference in $g$ between the largest and smallest values was 0.084 (41%) when each study was deleted. With the one outlier deleted from the model, the alpha value for $g$ increased to 0.12 and heterogeneity, while still statistically significant ($Q = 42.2$, $p = 0.02$), was reduced to 48.5%. The benefits in LS BMD remained statistically significant when data were collapsed so that only one $g$ represented each study ($g = 0.231$, 95% CI = 0.026, 0.435, $p = 0.03$, $Q = 71.1$, $p < 0.0001$, $I^2 = 71.9\%$). Cumulative meta-analysis, ranked by year, demonstrated that results have been statistically significant, or there has been a trend for statistical significance, since 2009 (Figure 8).

Moderator analysis for changes in LS BMD is shown in Additional file 3. As can be seen, no statistically significant between-group differences ($Q_b$) were found for those *a priori* comparisons in which sufficient data were available.

Meta-regression analyses for changes in LS BMD are shown in Additional file 4. As shown, there was a statistically significant association between increases in LS BMD and older age, greater number of years postmenopausal, fewer minutes of training per session (aerobic groups only), fewer minutes of training per week, greater

| Study name | Subgroup within study | Point | Lower limit | Upper limit | p-Value |
|---|---|---|---|---|---|
| Bocalini et al., 2009 | None | 0.231 | 0.086 | 0.376 | 0.002 |
| Jessup et al., 2003 | None | 0.250 | 0.072 | 0.428 | 0.006 |
| Rhodes et al., 2000 | None | 0.255 | 0.071 | 0.438 | 0.007 |
| Kemmler et al., 2010 | None | 0.268 | 0.078 | 0.458 | 0.006 |
| Marques et al., 2011b | None | 0.270 | 0.080 | 0.460 | 0.005 |
| Nelson et al., 1994 | None | 0.273 | 0.084 | 0.463 | 0.005 |
| Choquette et al., 2011 | None | 0.284 | 0.092 | 0.475 | 0.004 |
| Kerr et al., 2001 | weight training | 0.284 | 0.091 | 0.477 | 0.004 |
| Kerr et al., 1996 | weight training (low load, high reps) | 0.288 | 0.096 | 0.480 | 0.003 |
| Prince et al., 1995 | None | 0.290 | 0.096 | 0.484 | 0.003 |
| Newstead et al., 2004 | None | 0.290 | 0.098 | 0.483 | 0.003 |
| Liu-Ambrose et al., 2004 | agility training | 0.291 | 0.097 | 0.484 | 0.003 |
| Brentano et al., 2008 | weight training | 0.292 | 0.102 | 0.482 | 0.003 |
| Going et al., 2003 | no hrt | 0.293 | 0.096 | 0.490 | 0.004 |
| Kerr et al., 1996 | weight training (high load, low reps) | 0.295 | 0.103 | 0.487 | 0.003 |
| Marques et al., 2011a | aerobic training | 0.296 | 0.103 | 0.488 | 0.003 |
| Chilibeck et al., 2002 | None | 0.296 | 0.106 | 0.486 | 0.002 |
| Going et al., 2003 | hrt | 0.297 | 0.100 | 0.494 | 0.003 |
| Bassey et al., 1998 | hrt | 0.298 | 0.106 | 0.489 | 0.002 |
| Brooke-Wavell et al., 1997 | None | 0.298 | 0.104 | 0.492 | 0.003 |
| Englund et al., 2005 | None | 0.299 | 0.108 | 0.490 | 0.002 |
| Kerr et al., 2001 | circuit training | 0.299 | 0.106 | 0.492 | 0.002 |
| Wu et al., 2006 | None | 0.301 | 0.109 | 0.494 | 0.002 |
| Liu-Ambrose et al., 2004 | weight training | 0.303 | 0.111 | 0.495 | 0.002 |
| Marques et al., 2011a | weight training | 0.306 | 0.115 | 0.496 | 0.002 |
| Bergstrom et al., 2008 | None | 0.308 | 0.116 | 0.499 | 0.002 |
| Brentano et al., 2008 | circuit training | 0.309 | 0.123 | 0.495 | 0.001 |
| Bassey et al., 1998 | no hrt | 0.312 | 0.125 | 0.500 | 0.001 |
| | | 0.288 | 0.102 | 0.474 | 0.002 |

Statistics with study removed

Point estimate (95% CI) with study removed

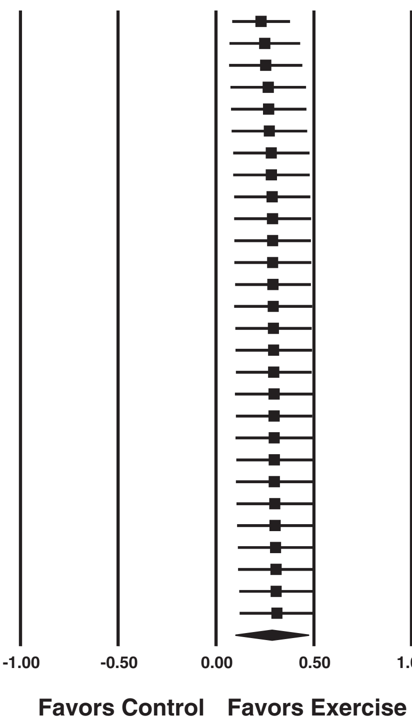


**Figure 4 Influence analysis for changes in FN BMD.** Influence analysis for point estimate standardized effect size changes (*g*) in FN BMD with each corresponding study deleted from the model once. The black squares represent the standardized mean difference (*g*) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (*g*) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Results are ordered from smallest to largest values of *g*. For subgroup, HRT means hormone replacement therapy.

intensity of training (strength only), increased compliance (strength only), decreased compliance (combined aerobic and strength training only), increases in static balance, decreases in BMI, body weight and percent body fat. A trend for a statistically significant association was found between increases in LS BMD and smaller increases in aerobic fitness as well as increases in lean body mass.

### Secondary outcomes

Changes in secondary outcomes are shown in Table 3. As can be seen there was a statistically significant benefit in BMD at the total hip, trochanteric and intertrochanteric regions. A non-significant and small to nil amount of heterogeneity was observed for all three outcomes. In addition, non-overlapping prediction intervals were observed for the trochanteric region. Furthermore, large, statistically significant improvements as well as statistically significant and large amounts of heterogeneity were found for aerobic fitness, dynamic and static balance. For body composition, a trend for statistically significant increases in LBM along with a statistically significant and moderate amount of heterogeneity was observed. A statistically significant decrease as well as a statistically significant and moderate amount of heterogeneity was also observed for percent body fat. For both upper and lower body strength, large, statistically significant increases were observed as well as large and statistically significant amounts of heterogeneity. Insufficient data were available to examine differences in fractures between the exercise and control groups.

## Discussion

The purpose of this study was to use the aggregate data meta-analytic approach to determine the effects of ground and/or joint reaction force exercise on BMD at the FN and LS in postmenopausal women participating in exercise levels below that currently recommended for bone health [8]. The overall results suggest that ground and joint reaction force exercise may result in clinically important benefits in FN and LS BMD, with results more convincing for FN BMD. These findings are

| Study name | Subgroup within study | Cumulative statistics | | | |
|---|---|---|---|---|---|
| | | Point | Lower limit | Upper limit | p-Value |
| Nelson et al., 1994 | None | 0.713 | 0.065 | 1.360 | 0.031 |
| Prince et al., 1995 | None | 0.444 | 0.042 | 0.846 | 0.031 |
| Kerr et al., 1996 | weight training (high load, low reps) | 0.348 | 0.025 | 0.670 | 0.035 |
| Kerr et al., 1996 | weight training (low load, high reps) | 0.342 | 0.054 | 0.630 | 0.020 |
| Brooke-Wavell et al., 1997 | None | 0.273 | 0.031 | 0.515 | 0.027 |
| Bassey et al., 1998 | hrt | 0.242 | 0.019 | 0.465 | 0.033 |
| Bassey et al., 1998 | no hrt | 0.145 | -0.081 | 0.371 | 0.207 |
| Rhodes et al., 2000 | None | 0.271 | -0.025 | 0.568 | 0.073 |
| Kerr et al., 2001 | circuit training | 0.239 | -0.021 | 0.500 | 0.072 |
| Kerr et al., 2001 | weight training | 0.255 | 0.019 | 0.492 | 0.034 |
| Chilibeck et al., 2002 | None | 0.240 | 0.018 | 0.462 | 0.034 |
| Going et al., 2003 | hrt | 0.226 | 0.034 | 0.419 | 0.021 |
| Going et al., 2003 | no hrt | 0.225 | 0.055 | 0.395 | 0.009 |
| Jessup et al., 2003 | None | 0.291 | 0.079 | 0.502 | 0.007 |
| Liu-Ambrose et al., 2004 | agility training | 0.284 | 0.089 | 0.480 | 0.004 |
| Liu-Ambrose et al., 2004 | weight training | 0.260 | 0.074 | 0.446 | 0.006 |
| Newstead et al., 2004 | None | 0.258 | 0.082 | 0.433 | 0.004 |
| Englund et al., 2005 | None | 0.244 | 0.076 | 0.411 | 0.004 |
| Wu et al., 2006 | None | 0.228 | 0.068 | 0.387 | 0.005 |
| Bergstrom et al., 2008 | None | 0.204 | 0.049 | 0.358 | 0.010 |
| Brentano et al., 2008 | circuit training | 0.187 | 0.030 | 0.343 | 0.019 |
| Brentano et al., 2008 | weight training | 0.184 | 0.032 | 0.336 | 0.017 |
| Bocalini et al., 2009 | None | 0.271 | 0.057 | 0.486 | 0.013 |
| Kemmler et al., 2010 | None | 0.293 | 0.084 | 0.502 | 0.006 |
| Choquette et al., 2011 | None | 0.297 | 0.095 | 0.499 | 0.004 |
| Marques et al., 2011a | aerobic training | 0.288 | 0.094 | 0.483 | 0.004 |
| Marques et al., 2011a | weight training | 0.270 | 0.080 | 0.460 | 0.005 |
| Marques et al., 2011b | None | 0.288 | 0.102 | 0.474 | 0.002 |
| | | 0.288 | 0.102 | 0.474 | 0.002 |

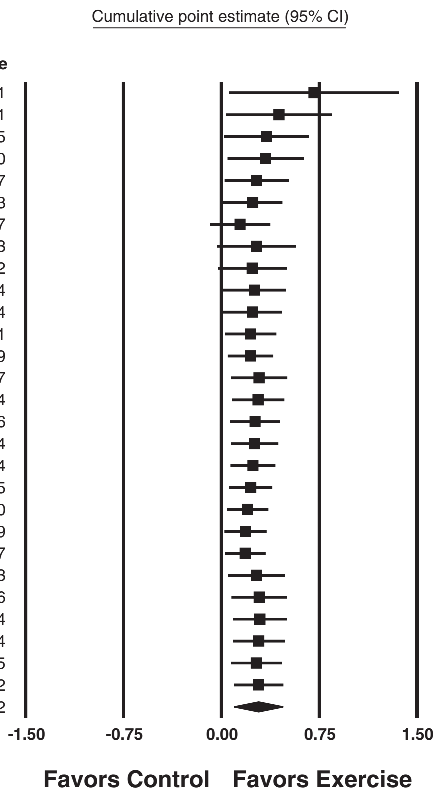


**Figure 5 Cumulative meta-analysis for changes in FN BMD.** Cumulative meta-analysis, ordered by year, for point estimate standardized effect size changes (*g*) in FN BMD. The black squares represent the standardized mean difference (*g*) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The results of each corresponding study are pooled with all studies preceding it. The middle of the black diamond represents the overall standardized mean difference (*g*) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. For subgroup, HRT means hormone replacement therapy.

similar to those from three [48,51,53] of four [37,48,51,53] previous meta-analyses for FN BMD and four [37,39,48,53] of five [37,39,48,51,53] previous meta-analyses for LS BMD, all of which included both ground and joint reaction force exercises from randomized controlled trials in postmenopausal women. Further support for the overall findings of the current meta-analysis were strengthened by the robustness of results when data were collapsed so that only one *g* represented each study as well as when examined for publication bias. When each study was deleted from the model once, results remained statistically significant for FN BMD across all deletions but were no longer statistically significant for LS BMD ($p = 0.12$) when one study was deleted from the model [11]. From a stability perspective, the statistical significance of findings has been consistent over a longer period of time for BMD at the FN (2000) versus LS (2009). Thus, the changes in BMD appear to be more convincing for FN versus LS BMD. This may have to do with the possibility that the exercise protocols employed were more specific to the FN versus LS.

While random-effects models that incorporate heterogeneity into the analysis were used, it is still important to point out that heterogeneity was observed for both FN and LS BMD. The existence of heterogeneity in meta-analysis is not only common [79], but also important, as there is no need to combine studies exactly alike since their findings, within statistical error, would be the same [80]. In addition, prediction intervals for estimating the expected results of a new trial included zero for both FN and LS BMD. However, these values should not be confused with confidence intervals since prediction intervals are based on a random mean effect while confidence intervals are not [73]. Nevertheless, these prediction intervals may be beneficial for future researchers interested in conducting randomized controlled intervention trials addressing the effects of ground and/or joint reaction force exercise on FN and LS BMD in postmenopausal women.

While the magnitude of change in FN and LS BMD might be considered small at the FN and trivial at the LS, they appear to be clinically important. For example, based on previous prediction models [81], the exercise-

| Study name | Subgroup within study | Point estimate | Lower limit | Upper limit |
|---|---|---|---|---|
| Bassey et al., 1998 | hrt | -0.151 | -0.730 | 0.429 |
| Bassey et al., 1998 | no hrt | -0.030 | -0.483 | 0.423 |
| Bergstrom et al., 2008 | None | 0.023 | -0.350 | 0.396 |
| Bocalini et al., 2009 | None | 3.475 | 2.223 | 4.727 |
| Brentano et al., 2008 | circuit training | -0.970 | -1.922 | -0.019 |
| Brentano et al., 2008 | strength training | -0.367 | -1.298 | 0.565 |
| Brooke-Wavell et al., 1997 | None | 0.167 | -0.278 | 0.612 |
| Chilibeck et al., 2002 | None | -0.091 | -0.930 | 0.749 |
| Choquette et al., 2011 | None | -0.417 | -1.047 | 0.212 |
| Englund et al., 2005 | None | 0.242 | -0.381 | 0.864 |
| Going et al., 2003 | hrt | -0.079 | -0.416 | 0.257 |
| Going et al., 2003 | no hrt | 0.219 | -0.127 | 0.565 |
| Grove & Londeree, 1992 | high impact | 1.426 | 0.038 | 2.814 |
| Grove & Londeree, 1992 | low impact | 1.084 | -0.243 | 2.412 |
| Hong, 2004 | tai chi | -0.349 | -0.868 | 0.170 |
| Hong, 2004 | weight training | 0.376 | -0.134 | 0.887 |
| Iwamoto et al., 2001 | None | 1.029 | 0.166 | 1.892 |
| Jessup et al., 2003 | None | 1.124 | 0.130 | 2.118 |
| Kemmler et al., 2010 | None | 0.519 | 0.254 | 0.783 |
| Kerr et al., 2001 | circuit training | -0.159 | -0.645 | 0.326 |
| Kerr et al., 2001 | weight training | -0.310 | -0.830 | 0.209 |
| Marques et al., 2011 | None | 0.401 | -0.110 | 0.912 |
| Martin & Notelovitz, 1993 | 30 minutes | 0.043 | -0.585 | 0.671 |
| Martin & Notelovitz, 1993 | 45 minutes | 0.215 | -0.452 | 0.882 |
| Nelson et al., 1994 | None | 0.807 | 0.154 | 1.460 |
| Newstead et al., 2004 | None | 0.000 | -0.561 | 0.561 |
| Rhodes et al., 2000 | None | 0.379 | -0.264 | 1.021 |
| Wu et al., 2006 | None | -0.177 | -0.668 | 0.314 |
| | | 0.179 | -0.003 | 0.361 |

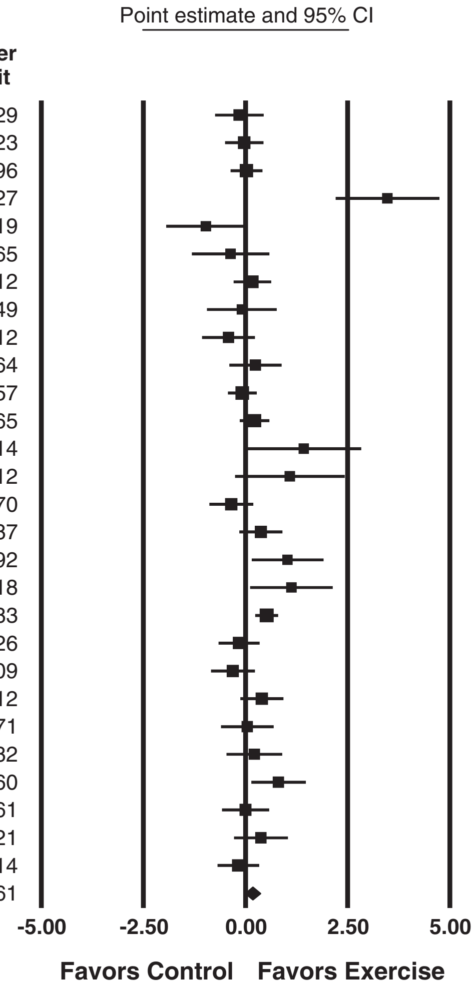


**Figure 6 Forest plot for changes in LS BMD.** Forest plot for point estimate standardized effect size changes (*g*) in LS BMD. The black squares represent the standardized mean difference (*g*) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (*g*) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. For subgroup, HRT means hormone replacement therapy.

induced changes in BMD observed at the FN and LS in the current meta-analysis would reduce the 20-year relative risk of osteoporotic fracture at any site by approximately 11% and 10%, respectively. However, the observed benefits of exercise on FN ($g = 0.29$) and LS ($g = 0.18$) BMD in the current meta-analysis were smaller than those previously reported for pharmacologic interventions (alendronate, calcitonin, etidronate, hormone therapy, raloxifine, risedronate) at both the hip (range of $g = 0.64$ to 5.74) and LS (range of $g = 0.90$ to 8.90) [82]. The exercise-induced benefits on FN and LS BMD also appear to be similar to or smaller than those observed for calcium and vitamin D supplementation ($g$ for calcium = 0.45 at the hip and 1.57 at the LS; $g$ for vitamin D = 0.47 at the hip and 0.20 at the LS) [82]. However, the use of pharmacological and nutritional interventions should be considered with respect to several factors. These include: (1) the potential adverse effects of pharmacologic agents [83], (2) that participants included in previous pharmacological and nutritional intervention studies had generally lower initial levels of BMD than participants included in the current exercise meta-analysis [83], and (3) that exercise results in numerous other benefits not realized with pharmacologic and nutritional interventions [84], for example, increases in balance and a subsequent reduction in falls [85]. Given the former, the current recommendations of lifestyle changes such as exercise and adequate calcium and vitamin D intake prior to pharmacological intervention appear to be appropriate [6].

The focus of the present meta-analysis has been on the use of the traditional alpha value for statistical significance

| Study name | Subgroup within study | Statistics with study removed: Point | Lower limit | Upper limit | p-Value |
|---|---|---|---|---|---|
| Bocalini et al., 2009 | None | 0.119 | -0.031 | 0.269 | 0.119 |
| Iwamoto et al., 2001 | None | 0.155 | -0.027 | 0.337 | 0.095 |
| Nelson et al., 1994 | None | 0.156 | -0.028 | 0.339 | 0.097 |
| Jessup et al., 2003 | None | 0.157 | -0.025 | 0.339 | 0.091 |
| Kemmler et al., 2010 | None | 0.159 | -0.028 | 0.346 | 0.095 |
| Grove & Londeree, 1992 | high impact | 0.161 | -0.020 | 0.342 | 0.082 |
| Grove & Londeree, 1992 | low impact | 0.165 | -0.017 | 0.348 | 0.076 |
| Marques et al., 2011 | None | 0.171 | -0.018 | 0.360 | 0.076 |
| Hong, 2004 | weight training | 0.172 | -0.017 | 0.361 | 0.074 |
| Rhodes et al., 2000 | None | 0.173 | -0.015 | 0.361 | 0.071 |
| Englund et al., 2005 | None | 0.178 | -0.010 | 0.367 | 0.064 |
| Martin & Notelovitz, 1993 | 45 minutes | 0.179 | -0.009 | 0.367 | 0.062 |
| Going et al., 2003 | no hrt | 0.181 | -0.013 | 0.374 | 0.067 |
| Brooke-Wavell et al., 1997 | None | 0.182 | -0.009 | 0.373 | 0.061 |
| Martin & Notelovitz, 1993 | 30 minutes | 0.186 | -0.003 | 0.374 | 0.053 |
| Chilibeck et al., 2002 | None | 0.188 | 0.001 | 0.374 | 0.049 |
| Newstead et al., 2004 | None | 0.188 | -0.001 | 0.377 | 0.051 |
| Bergstrom et al., 2008 | None | 0.190 | -0.002 | 0.382 | 0.052 |
| Bassey et al., 1998 | no hrt | 0.191 | 0.001 | 0.381 | 0.049 |
| Brentano et al., 2008 | strength training | 0.193 | 0.008 | 0.378 | 0.041 |
| Bassey et al., 1998 | hrt | 0.193 | 0.006 | 0.381 | 0.044 |
| Kerr et al., 2001 | circuit training | 0.195 | 0.007 | 0.384 | 0.042 |
| Going et al., 2003 | hrt | 0.195 | 0.004 | 0.387 | 0.046 |
| Wu et al., 2006 | None | 0.196 | 0.008 | 0.384 | 0.041 |
| Kerr et al., 2001 | weight training | 0.200 | 0.014 | 0.386 | 0.035 |
| Choquette et al., 2011 | None | 0.200 | 0.016 | 0.385 | 0.033 |
| Hong, 2004 | tai chi | 0.201 | 0.016 | 0.387 | 0.033 |
| Brentano et al., 2008 | circuit training | 0.203 | 0.023 | 0.383 | 0.027 |
| | | 0.179 | -0.003 | 0.361 | 0.054 |

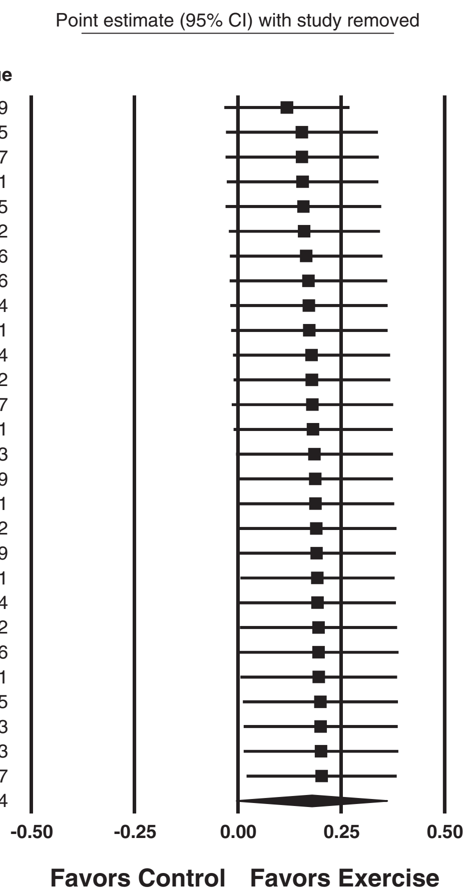


**Figure 7 Influence analysis for changes in LS BMD.** Influence analysis for point estimate standardized effect size changes (*g*) in LS BMD with each corresponding study deleted from the model once. The black squares represent the standardized mean difference (*g*) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference (*g*) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Results are ordered from smallest to largest values of *g*. For subgroup, HRT means hormone replacement therapy.

($p \leq 0.05$) and 95% CI. However, it has been suggested that rather than focus on the term statistically significant and alpha value cutpoints, one should report the exact alpha value and use 90% CI to determine clinical relevance within the range of the 90% interval [86]. Using the 90% CI approach, the interval no longer included zero (0) for changes in LS BMD (0.026 to 0.332) and ranged from 0.132 to 0.444 for changes in FN BMD.

No statistically significant between-group differences were found when mixed-effects ANOVA was conducted for changes in FN and LS BMD partitioned by a large number of categorical variables. However, while no statistically significant between-group differences were noted, changes in FN BMD were smaller for ground ($g = 0.088$) versus joint ($g = 0.420$) and combined joint and ground reaction force exercise ($g = 0.398$).

Several interesting associations were found when simple meta-regression was performed for changes in FN and LS BMD. For ease of reading, statistically significant findings ($p < 0.05$) as well as trends for statistical significance (>0.05 but ≤ 0.10) are discussed collectively. For both FN and LS BMD, greater increases were associated with both greater intensity and compliance in the strength training (joint-reaction force) groups. These findings suggest that greater loads per repetition as well as greater adherence may provide greater benefit to FN and LS BMD. Greater improvements in both FN and LS BMD were also associated with increases in static balance. These associations may be especially important for reducing the risk of falling as well as subsequent fracture risk. Greater increases in both FN and LS BMD were also associated with decreases in BMI, body weight and percent body fat. In addition, increases in LS BMD were associated with increases in LBM. All of these associations may be reflective of greater exercise effort. The inverse association between increases in both FN and LS BMD with poorer compliance to

| Study name | Subgroup within study | Cumulative statistics | | | |
|---|---|---|---|---|---|
| | | Point | Lower limit | Upper limit | p-Value |
| Grove & Londeree, 1992 | high impact | 1.426 | 0.038 | 2.814 | 0.044 |
| Grove & Londeree, 1992 | low impact | 1.247 | 0.288 | 2.207 | 0.011 |
| Martin & Notelovitz, 1993 | 30 minutes | 0.678 | -0.246 | 1.601 | 0.150 |
| Martin & Notelovitz, 1993 | 45 minutes | 0.428 | -0.122 | 0.977 | 0.127 |
| Nelson et al., 1994 | None | 0.520 | 0.068 | 0.971 | 0.024 |
| Brooke-Wavell et al., 1997 | None | 0.402 | 0.053 | 0.752 | 0.024 |
| Bassey et al., 1998 | hrt | 0.309 | -0.021 | 0.640 | 0.067 |
| Bassey et al., 1998 | no hrt | 0.237 | -0.047 | 0.521 | 0.101 |
| Rhodes et al., 2000 | None | 0.244 | -0.007 | 0.495 | 0.057 |
| Iwamoto et al., 2001 | None | 0.313 | 0.048 | 0.577 | 0.021 |
| Kerr et al., 2001 | circuit training | 0.255 | 0.004 | 0.505 | 0.046 |
| Kerr et al., 2001 | weight training | 0.201 | -0.044 | 0.447 | 0.109 |
| Chilibeck et al., 2002 | None | 0.180 | -0.052 | 0.411 | 0.128 |
| Going et al., 2003 | hrt | 0.140 | -0.067 | 0.347 | 0.185 |
| Going et al., 2003 | no hrt | 0.142 | -0.043 | 0.327 | 0.132 |
| Jessup et al., 2003 | None | 0.181 | -0.013 | 0.375 | 0.068 |
| Hong, 2004 | tai chi | 0.147 | -0.045 | 0.338 | 0.133 |
| Hong, 2004 | weight training | 0.160 | -0.022 | 0.342 | 0.085 |
| Newstead et al., 2004 | None | 0.147 | -0.025 | 0.319 | 0.094 |
| Englund et al., 2005 | None | 0.148 | -0.015 | 0.312 | 0.076 |
| Wu et al., 2006 | None | 0.128 | -0.030 | 0.285 | 0.111 |
| Bergstrom et al., 2008 | None | 0.116 | -0.030 | 0.262 | 0.120 |
| Brentano et al., 2008 | circuit training | 0.099 | -0.054 | 0.253 | 0.203 |
| Brentano et al., 2008 | strength training | 0.089 | -0.062 | 0.240 | 0.247 |
| Bocalini et al., 2009 | None | 0.173 | -0.025 | 0.370 | 0.086 |
| Kemmler et al., 2010 | None | 0.193 | 0.002 | 0.385 | 0.048 |
| Choquette et al., 2011 | None | 0.171 | -0.018 | 0.360 | 0.076 |
| Marques et al., 2011 | None | 0.179 | -0.003 | 0.361 | 0.054 |
| | | 0.179 | -0.003 | 0.361 | 0.054 |

Cumulative point estimate (95% CI)

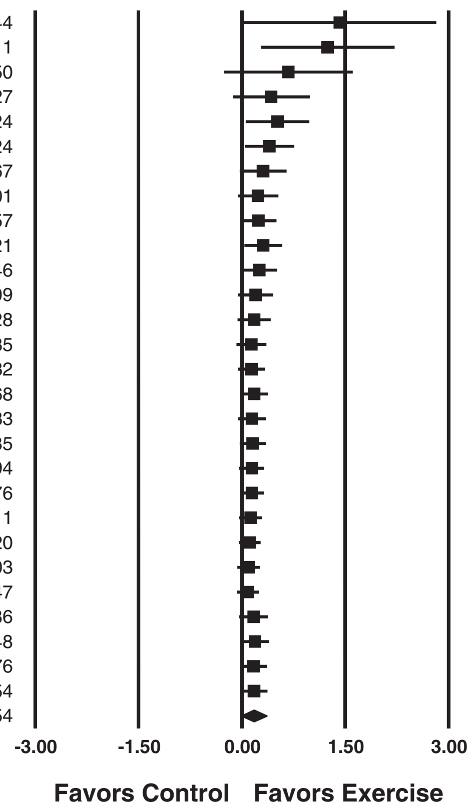


**Figure 8 Cumulative meta-analysis for changes in LS BMD.** Cumulative meta-analysis, ordered by year, for point estimate standardized effect size changes (*g*) in LS BMD. The black squares represent the standardized mean difference (*g*) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The results of each corresponding study are pooled with all studies preceding it. The middle of the black diamond represents the overall standardized mean difference (*g*) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. For subgroup, HRT means hormone replacement therapy.

aerobic and strength training protocols may be nothing more than the play of chance. Alternatively, studies with poorer compliance may have yielded greater benefits in FN and LS BMD because of the greater overall volume of training prescribed. For LS BMD, the positive association between increases in LS BMD and older age as well as a greater number of years postmenopausal may be the result of lower initial levels of BMD. However, we found no association between baseline LS BMD and changes in LS BMD. The negative associations between increases in LS BMD with shorter duration and total minutes of training per week for aerobic exercise studies may help to reinforce the belief that shorter duration activities such as jumping may be more beneficial to LS BMD than activities such as walking [7]. One potential reason for this negative association may be the result of calcium loss from excessive sweating in longer duration and/or higher intensity activities [87,88]. This causes a decrease in serum calcium followed by an increase in serum parathyroid hormone, which then stimulates bone resorption [87,88]. While these findings are interesting, further research is needed before any firm conclusions can be drawn.

In addition to changes in FN and LS BMD, statistically significant improvements were found for several secondary outcomes. These included increases in BMD (total hip, trochanteric, intertrochanteric), aerobic fitness, dynamic and static balance, lean body mass and both upper and lower body strength. Statistically significant decreases in percent body fat were also found. These findings reinforce the many benefits that can be derived from exercise programs [84]. The former notwithstanding, the results for secondary outcomes should be interpreted with caution since they were only included if FN and/or LS BMD data were reported. Consequently, secondary outcomes in meta-analysis may not comprise a representative sample.

A major interest of the investigative team was to examine the dose–response relationship between changes in FN and LS BMD and exercise load ratings in postmenopausal women. While we found no significant association between changes in FN and LS BMD and load ratings, these associations were based on general categorical estimates versus estimates specific to each activity [59]. The decision to use categorical estimates was based on the inability to accurately calculate load ratings for those studies that involved multiple types of activities. In addition, the algorithm used requires further testing, improvement and validation [59]. Future research should also focus on developing formulas for accurately calculating load ratings from data typically provided in randomized controlled intervention trials. Ideally, individual studies should collect and report force data in all exercise interventions. However, the accurate measurement of such may be challenging for some activities [7]. Until additional dose–response research is conducted, it would appear plausible to suggest that postmenopausal women adhere to the exercise guidelines from the American College of Sports Medicine [8]. These include weight-bearing endurance activities 3 to 5 times per week as well as resistance exercise 2 to 3 times per week [8]. However, it will be particularly important for future dose–response studies to determine whether increased duration of aerobic exercise diminishes the potential skeletal benefits, as suggested by the current regression analyses.

The results of this meta-analysis should be viewed with respect to several potential limitations. First, because studies are not randomly assigned to covariates, they are considered to be observational in nature. Therefore, the results of moderator and regression analyses conducted in this or any other meta-analysis do not support causal inferences [78]. Second, because a large number of statistical tests were conducted, some statistically significant results could have been nothing more than the play of chance. However, as suggested by Rothman [89], no adjustment was made for multiple tests because of the concern about missing possibly important findings. Third, because of a lack of data, a common occurrence in meta-analysis, the research team was unable to examine several variables, thereby compromising the thoroughness of the study. With the former in mind, it is suggested that future randomized controlled trials addressing the effects of ground and/or joint reaction force exercise on FN and LS BMD in postmenopausal women include information regarding study design (allocation concealment, incomplete outcome data, verification that all outcomes planned to be assessed are reported), participant characteristics (adverse events, whether the participants had osteoporosis, cigarette smoking, alcohol consumption, change in exercise habits outside the intervention) and exercise intervention characteristics (intensity, how exercise was delivered). Fourth, future studies should provide more specific information regarding their exercise cutpoints for enrolling participants in their studies. The heterogeneity of reporting found in the current meta-analysis is not surprising. In a systematic review of the different definitions of sedentary for screening participants for entrance into physical activity intervention trials, Bennett et al. [90], found that the definition of sedentary ranged from less than 20 to less than 150 minutes per week minutes of physical activity and that few studies reported the type and intensity of physical activity used to screen participants. While such varied definitions may make it difficult to generalize findings, the current meta-analysis, to the best of the authors' knowledge, is the first one on exercise and BMD in women to limit the inclusion of studies to those in which participants were not currently meeting exercise recommendations for bone health [8]. Fifth, given the potential advantage of high resolution peripheral quantitative computed tomography (HR-pQCT) for detecting microarchitectural changes in bone [91], it would appear plausible to suggest that future exercise intervention studies should use this technology so as to better understand the exercise-induced changes that may occur in bone. Finally, consistent with recommendations from the 2008 Physical Activity Guidelines Report, there continues to be a need for large randomized controlled trials to determine whether fracture incidence is decreased as a result of ground and/or joint reaction force exercise [7].

## Conclusions

The overall findings of this aggregate data meta-analysis suggest that exercise may result in clinically relevant benefits to FN and LS BMD in postmenopausal women. Several observed and important associations appear worthy of further investigation in well-designed randomized controlled trials.

## Additional files

**Additional file 1: Example of search strategy for one database search (SPORTDiscus).** This additional file describes the search strategy used searching the SPORTDiscus database for randomized controlled trials dealing with the effects of exercise on bone mineral density in adults.

**Additional file 2: General characteristics of included studies.** This additional file provides a description of the general characteristics of studies that met the inclusion criteria for the meta-analysis.

**Additional file 3: Table of moderator analyses results for FN and LS BMD.** This additional file provides a table of results for all moderator analyses that were conducted for categorical variables and changes in femoral neck and lumbar spine bone mineral density.

**Additional file 4: Table of meta-regression results for changes in FN and LS BMD.** This additional file provides a table of results for all regression analyses that were conducted for changes in femoral neck and lumbar spine bone mineral density.

**Competing interests**

The authors declare that they have no competing interests.

**Authors' contributions**

GAK was responsible for the conception and design, acquisition of data, analysis and interpretation of data, drafting the initial manuscript and revising it critically for important intellectual content. KSK was responsible for the conception and design, acquisition of data, and reviewing all drafts of the manuscript. WMK was responsible for the conception and design, interpretation of data and reviewing all drafts of the manuscript. All authors read and approved the final manuscript.

**Authors' information**

GAK has more than 15 years of successful experience in the design and conduct of all aspects of meta-analysis, including the effects of chronic exercise on bone mineral density in adult humans. KSK has more than 12 years of successful experience in conducting meta-analysis, including the effects of chronic exercise on bone mineral density in adult humans. WMK is a leading authority on the effects of exercise on bone mineral density.

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*Review Article*

# Exercise and Bone Mineral Density in Premenopausal Women: A Meta-Analysis of Randomized Controlled Trials

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*Objective*. Examine the effects of exercise on femoral neck (FN) and lumbar spine (LS) bone mineral density (BMD) in premenopausal women. *Methods*. Meta-analysis of randomized controlled exercise trials ≥24 weeks in premenopausal women. Standardized effect sizes ($g$) were calculated for each result and pooled using random-effects models, $Z$ score alpha values, 95% confidence intervals (CIs), and number needed to treat (NNT). Heterogeneity was examined using $Q$ and $I^2$. Moderator and predictor analyses using mixed-effects ANOVA and simple metaregression were conducted. Statistical significance was set at $P \leq 0.05$. *Results*. Statistically significant improvements were found for both FN ($7g$'s, 466 participants, $g = 0.342$, 95% CI = 0.132, 0.553, $P = 0.001$, $Q = 10.8$, $P = 0.22$, $I^2 = 25.7\%$, NNT = 5) and LS ($6g$'s, 402 participants, $g = 0.201$, 95% CI = 0.009, 0.394, $P = 0.04$, $Q = 3.3$, $P = 0.65$, $I^2 = 0\%$, NNT = 9) BMD. A trend for greater benefits in FN BMD was observed for studies published in countries other than the United States and for those who participated in home versus facility-based exercise. Statistically significant, or a trend for statistically significant, associations were observed for 7 different moderators and predictors, 6 for FN BMD and 1 for LS BMD. *Conclusions*. Exercise benefits FN and LS BMD in premenopausal women. The observed moderators and predictors deserve further investigation in well-designed randomized controlled trials.

## 1. Introduction

Bone is a living tissue that undergoes continuous remodeling as a result of bone resorption and formation whereby osteoclasts remove bone and osteoblasts create new bone [1]. A dynamic tissue, bone, adapts to the associated mechanical stresses, such as exercise, that are placed on it [2]. Currently, mechanotransduction is the predominant mechanism through which mechanical stimuli such as exercise are believed to benefit bone [3, 4]. While not entirely understood, this appears to involve the detection of mechanical stimuli by osteocytes and the transduction of this mechanical strain by osteocytes to osteoclasts and osteoblasts where bone resorption and remodeling take place [4, 5], the end result being enhanced bone formation. At the cellular level, exercise may reduce the secretion of sclerostin by the osteocyte, thereby upregulating Wnt signaling and osteoblastogenesis, that is, bone formation [6–8]. To support this contention, both cross-sectional and longitudinal studies have shown that physically active premenopausal women have lower sclerostin levels than those who are sedentary [9, 10]. In a cross-sectional study of 1,235 randomly selected premenopausal women, those who participated in more than 120 minutes of physical activity per week were shown to have serum sclerostin levels that were 36.8% lower than sedentary controls [9]. In a longitudinal follow-up study with 120 of these same women who took part in either an 8-week, 4 days per week, exercise ($n = 58$) or control ($n = 62$) condition, serum sclerostin levels were 33.9% lower in the exercise versus control group [9].

Maintaining optimal bone mineral density (BMD) levels during the premenopausal years is important for reducing the risk of osteoporosis and subsequent fractures during the

postmenopausal years, with relative-risk increases ranging from 1.5 to 3.0 [11]. In addition, the prevalence of osteopenia and osteoporosis has been reported to be 15% and 0.6%, respectively, in premenopausal women [12]. Furthermore, it has been estimated that the loss of BMD ranges from 0.25% to 1% per year in premenopausal women [11]. While pharmacologic therapy is usually contraindicated in premenopausal women, reliance on lifestyle factors is almost always recommended [11, 13]. One potentially effective lifestyle approach for achieving this goal is exercise, a low-cost, nonpharmacologic intervention that is available to the vast majority of the population. Unfortunately, previous randomized controlled trials addressing the effects of joint and/or ground reaction force exercise on femoral neck (FN) and lumbar spine (LS) BMD in premenopausal women have led to conflicting and less than overwhelming results, with only 30% and 29% of findings reported as statistically significant at the FN and LS, respectively [14–20]. Using the traditional vote-counting approach [21], one might conclude that exercise does not benefit FN or LS BMD. However, a vote-counting approach based on statistical significance can be extremely misleading since the absence of a statistically significant effect does not mean absence of an effect [21]. In contrast, meta-analysis is a quantitative approach that enables one to go beyond statistical significance and focus on the magnitude of effect [22].

While a number of meta-analyses have been conducted on the effects of exercise on BMD in adults [23–45], none have focused exclusively on FN and/or LS BMD when limited to randomized controlled trials in premenopausal women. However, three meta-analyses have reported subgroup findings when limited to randomized controlled trials [37, 41, 44]. First, Wallace and Cumming reported a statistically significant and positive effect of both impact (1.5%) and nonimpact (1.2%) exercises on LS BMD [44]. A nonsignificant improvement of approximately 0.9% was found at the FN after impact exercise while an insufficient number of studies were available to examine nonimpact exercise [44]. A second meta-analysis that was limited to high-intensity resistance training reported a statistically significant benefit of 0.013 g/cm$^2$ for LS BMD and a nonsignificant effect of 0.001 g/cm$^2$ for FN BMD [37]. Based on a random-effects model and across all interventions, a third meta-analysis by the same research group reported a statistically significant benefit of 0.007 g/cm$^2$ at the LS and 0.012 g/cm$^2$ at the FN as a result of different impact modalities [41]. While the results of these meta-analyses are important, none were limited to randomized controlled trials. This is potentially problematic because randomized controlled trials are the only way to control for confounders that are not known or measured as well as the observation that nonrandomized controlled trials tend to overestimate the effects of healthcare interventions [46, 47]. In addition, none of these meta-analyses conducted moderator analyses for other variables when limited to randomized controlled trials [37, 41, 44]. Furthermore, none of the studies [37, 41, 44] provided any quantitative assessment of clinical relevance with respect to the number needed to treat (NNT) [48]. Given the former, the purpose of this study was to use the aggregate data meta-analytic approach to determine the overall effects, as well as potential moderators and predictors, of ground and joint reaction force exercise on FN and LS BMD in premenopausal women.

## 2. Methods

*2.1. Study Eligibility Criteria.* Studies were included if they met the following criteria: (1) randomized trials with a comparative control group (for example, nonintervention), (2) premenopausal women, as defined by the authors, (3) participants not engaged in a regular exercise program prior to study enrollment, (4) ground and/or joint reaction force exercise intervention of at least 24 weeks, (5) published and unpublished (master's theses and dissertations) studies since January 1989, and (6) data available for changes in BMD at the FN and/or LS and assessed using dual-energy X-ray absorptiometry (DEXA) or dual-photon absorptiometry (DPA). Any studies not meeting all six criteria were excluded.

Studies were limited to randomized controlled trials because trials are the only way to control for confounders that are not known or measured as well as the observation that nonrandomized controlled trials tend to overestimate the effects of healthcare interventions [46, 47]. The rationale for limiting studies to those in which the exercise intervention was at least 24 weeks in duration was based on the fact that bone remodeling, a continuous process in which damaged bone is repaired, ion homeostasis is maintained, and bone is reinforced for increased stress, typically takes around 24 weeks [49, 50]. Thus, it is unlikely that any true exercise-induced skeletal changes in BMD would occur prior to this. Because of the site specificity of exercise on BMD [51], resistance training studies were limited to those that included lower body exercise. The year 1989 was chosen as the start date for inclusion since it appeared to be the first time that a randomized controlled trial on exercise and BMD in adult humans was conducted [52].

*2.2. Data Sources.* Studies were retrieved from a large, previously developed database that included 1055 unique citations (see flow diagram in Supplementary File 1, available online at http://dx.doi.org/10.1155/2013/741639). Citations for the original database were retrieved from (1) six electronic sources (PubMed, Embase, SportDiscus, Cochrane Central Register of Controlled Clinical Trials, CINAHL, Dissertation Abstracts International), (2) cross-referencing from retrieved studies, including previous reviews, and (3) hand searching selected journals. Keywords germane to all searches were "exercise," "bone," and "randomized." In consultation with a Health Sciences librarian at West Virginia University, all searches were conducted by the second author (K. Kelly). The last search was conducted in August of 2011. In accordance with recent guidelines [53], an example of the search strategy used for one of the electronic databases (CINAHL) is shown in Supplementary File 2. Based on previous research suggesting that searching for unpublished data is probably not worth the effort, no attempt was made to retrieve such [54].

*2.3. Study Selection.* All studies were selected by the first two authors (G. Kelley and K. Kelley), independent of each other. They then reviewed their selections for accuracy and consistency. Discrepancies were resolved by consensus. If consensus could not be reached, the third author (W. Kohrt) was consulted and asked to provide a recommendation. The final list of selected studies was reviewed for thoroughness and completeness by the third author (W. Kohrt), an expert on exercise and BMD. A list of included and excluded studies, including the reasons for exclusion, was stored in version 12 of Reference Manger [55].

*2.4. Data Extraction.* Prior to data extraction, electronic codebooks were developed using Microsoft Excel 2007 [56]. Initial codebooks were developed by the first author (G. Kelley) with input from the second and third authors. Each codebook was then reviewed and tested by all three authors. Codebooks were then revised by the first author (G. Kelley) and reviewed and tested by all authors until final codebooks for data extraction were available after three iterations. The major categories of variables coded included (1) study characteristics (year of publication, risk of bias, etc.), (2) group characteristics (age, height, etc.) and (3) outcome characteristics (changes in FN and LS BMD, secondary outcomes, etc.). Codebooks could hold up to 324 items from each study.

The primary outcomes for this study, determined *a priori*, were changes in FN and LS BMD assessed by DEXA or DPA. Secondary outcomes, also established *a priori*, included changes in other BMD sites (whole body, Ward's triangle, intertrochanter, trochanter, total hip, radius, ulna, calcaneus, and os calcis), body weight, body mass index, lean body mass, percent body fat, fat mass, muscular strength (upper and/or lower), muscular power, cardiorespiratory fitness, balance (static and dynamic), calcium intake, vitamin D intake, and fractures.

All data were extracted by the first two authors (G. Kelley and K. Kelley), independent of each other. They then met and reviewed every selection for accuracy and consistency. Discrepancies were resolved by consensus. If consensus could not be reached, the third author (W. Kohrt) served as an arbitrator. Trials published as duplicate reports (parallel publications) were only included once, using all associated trial reports to maximally extract trial information, but ensuring that the trial data were not duplicated in the review.

*2.5. Risk of Bias Assessment.* Risk of bias was assessed using the risk of bias assessment tool from the Cochrane Collaboration [57]. This tool addresses specific domains, namely, sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, and selective outcome reporting. Each domain is classified as having either a high, low, or unclear risk of bias [57]. Given the objective nature of BMD assessment, all studies were considered low risk with respect to blinding. For selective outcome reporting, all studies were considered to be at an unclear risk for bias unless a study protocol identification number was provided. If a study protocol identification number was provided, an *a priori* decision was made to locate the project on the respective clinical trials website to see if the number and type of outcomes reported in the study matched the number and type of outcomes reported on the website. Risk of bias was assessed by the first two authors (G. Kelley and K. Kelley). They then met and reviewed every item for agreement. Disagreements were resolved by consensus.

*2.6. Statistical Analysis*

*2.6.1. Calculation of Effect Sizes from Each Study.* The primary outcomes for this study, that is, changes in FN and LS BMD, were calculated using the standardized effect size $g$ [58]. The standardized effect size was chosen over the original metric because of the different methods used to report data, for example, absolute versus relative changes in BMD, as well as the potential for excluding eligible studies because of the inability to retrieve necessary data. Each $g$ was calculated as follows [58]:

$$g_i = \frac{\overline{X}_e - \overline{X}_c}{\mathrm{SD}_{\mathrm{pooled}}}, \tag{1}$$

where $\overline{X}_e$ represents the changes score difference in the exercise group, $\overline{X}_c$ represents the change score difference in the control group, and $\mathrm{SD}_{\mathrm{pooled}}$ represents the pooled standard deviation from the change score standard deviations of the exercise and control groups. If absolute data were not available, relative (percent change) data were used.

For those studies that did not report original metric change score standard deviations, these were calculated from 95% confidence intervals if they were reported. If change score standard deviations and 95% confidence intervals were not available, change score standard deviations for each group (exercise and control) were calculated using the estimation approach of Follmann et al. [59]:

$$\mathrm{SD} = \sqrt{\left(\mathrm{SD}^2_{\mathrm{initial}} + \mathrm{SD}^2_{\mathrm{final}}\right) - 2\left(\mathrm{SD}_{\mathrm{initial}} * \mathrm{SD}_{\mathrm{final}} * \mathrm{Corr}_{\mathrm{intial,final}}\right)}, \tag{2}$$

where $\mathrm{SD}^2_{\mathrm{pre}}$ is the square of the standard deviation for the initial score, $\mathrm{SD}^2_{\mathrm{post}}$ is the square of the standard deviation for the final score, and $\mathrm{Corr}_{\mathrm{pre,post}}$ is the correlation between initial and final scores. Based on the association between initial and final scores, the imputed correlation for this study was 0.90. After original metric change score standard deviations were calculated from each study, the pooled standard deviation for $g$ was calculated as follows [58]:

$$\mathrm{SD}_{\mathrm{pooled}} = \sqrt{\frac{(n_e - 1)\,\mathrm{SD}^2_e + (n_c - 1)\,\mathrm{SD}^2_c}{n_e + n_c - 2}}, \tag{3}$$

where $\mathrm{SD}_{\mathrm{pooled}}$ is the pooled standard deviation for $g$, $n_e$ is the sample size in the exercise group, $n_c$ is the sample size in the control group, $\mathrm{SD}^2_e$ is the square of the standard deviation in the exercise group, and $\mathrm{SD}^2_c$ is the square of the standard

deviation in the control group. Each $g$ was then corrected for small sample bias by multiplying $g$ by a constant [58]:

$$g_i^* = c_i g_i, \tag{4}$$

where

$$c_i \approx 1 - \frac{3}{4(n_e + n_c - 2) - 1}. \tag{5}$$

The variance for each $g$ was then calculated as follows [58]:

$$\mathrm{Var}_{g_i} = \frac{n_e + n_c}{n_e n_c} + \frac{g_i^2}{2(n_e + n_c)}, \tag{6}$$

where $\mathrm{Var}_{g_i}$ is the variance for $g$, $n_e$ is the sample size in the exercise group, and $n_c$ is the sample size in the control group. For pooling purposes, each $g$ was then weighted by the inverse of the variance as follows [58]:

$$w_i = \frac{1}{\mathrm{Var}_{g_i}}, \tag{7}$$

where $w_i$ represents the weight and $\mathrm{Var}_{g_i}$ is the variance for each $g$.

Effect sizes for secondary outcomes (whole body BMD, Ward's triangle, intertrochanter, trochanter, total hip, radius, ulna, calcaneus, os calcis, upper and low body muscular strength, muscular power, and static and dynamic balance) were also calculated using $g$. Generally, the magnitude of effect for $g$ may be classified as trivial (<0.20), small (≥0.20 to <0.50), medium (≥0.50 to <0.80), or large (≥0.80) [60]. A $g$ of 0.30, for example, means that exercise would result in a 0.30 SD benefit over those who did not exercise. The original metric was used to calculate all other secondary outcomes: cardiorespiratory fitness ($VO_{2\,max}$ in $mL/kg^{-1}/min^{-1}$), body weight (kg), body mass index ($kg/m^2$), lean body mass (kg), percent body fat (%), fat mass (kg) calcium intake (mg/day), vitamin D intake (IU), and number of fractures.

*2.6.2. Effect Size Pooling.* All effect sizes were pooled using a random-effects, method of moments model [61]. This approach weights studies by the inverse of the variance and incorporates heterogeneity into the model [61]. For both primary and secondary outcomes, pooling was limited to those outcomes with at least 3 effect sizes. Multiple groups from the same study were analyzed independently as well as collapsing multiple groups so that only one effect size represented each outcome from each study. A two-tailed $Z$ score alpha value of ≤0.05 was considered to be statistically significant while alpha values >0.05 but ≤0.10 were considered as a trend. Precision was determined using two-tailed 95% confidence intervals (CIs). For outcomes with statistically significant results, estimation of treatment effects in a new trial was calculated using 95% prediction intervals (PIs) [62–64]. To enhance clinical relevance, the NNT was also estimated [48]. Analysis of secondary outcomes was considered exploratory because they were not part of the inclusion criteria, and thus, may represent a biased sample. After initial pooling, studies with statistically significant residuals (outliers) were deleted from all further analysis. The alpha value for statistically significant residuals was set at $P \le 0.05$. Because of a lack of data (<3 effect sizes), analysis of secondary outcomes was limited to changes in body weight and BMD at Ward's triangle and the trochanteric regions.

Statistical heterogeneity of pooled results based on fixed-effects models was examined using the $Q$ statistic and $I^2$, an extension of $Q$ that more accurately reflects statistical heterogeneity [65]. The alpha value for statistical significance for $Q$ was set at $P \le 0.10$. For $I^2$, values of 25% to <50% may be considered small, 50% to <75% medium, and ≥75% large [65]. For this study, $I^2$ values >50% were considered as excessive heterogeneity. Potential bias due to small-study effects was examined using the approach of Egger et al. and an alpha value for statistical significance of $P \le 0.05$ [66]. Small-study effects include such things as publication bias and the overestimation of treatment effects in studies of lower quality. For primary outcomes, influence analysis was conducted in order to examine the effects of each study on the overall results. In addition, cumulative meta-analysis, ranked by year, was also conducted [67].

*2.6.3. Moderator Analysis.* Mixed-effects, ANOVA-like models for meta-analysis were used to compare between-group differences ($Q_b$) in FN and LS BMD according to selected categorical variables, assuming that each category included at least 2$g$'s. A random-effects model was used to combine studies within each subgroup while a fixed-effect model was used to combine subgroups and yield the overall $g$. Between-study variance ($\tau^2$) was not assumed to be equal for all subgroups. *A priori* variables to examine included type of control group (nonintervention, other), matching (yes, no), risk of bias for sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting (low versus high risk), type of analysis (intention to treat, per protocol), provision of sample size estimates (yes, no), whether the study was funded (yes, no), adverse events (yes, no), race/ethnicity, drugs, other than hormone therapy, which could positively or negatively affect BMD (yes, no), hormone therapy, including oral contraceptives (yes, no), rheumatoid arthritis (yes, no), cigarette smoking (yes, no), alcohol consumption (yes, no), changes in physical activity habits outside the exercise intervention (yes, no), whether calcium or vitamin D supplements were given during the study (yes, no), previous fractures (yes, no), type of exercise (aerobic, strength, both), exercise supervision status (supervised, unsupervised, both), location in which exercise took place (facility, home, both), exercise participation (self, group, both), reaction forces (ground, joint, both), and instrument used to assess BMD (Lunar, Hologic). However, because of a lack of data (<2$g$'s per category), moderator analysis was limited to type of control group, type of analysis, sample size estimates, funding (FN only), calcium administration during the study (FN only), type of exercise (aerobic, strength), exercise supervision (FN only), location in which exercise took place (facility versus home, FN only), exercise participation (group versus self, FN only),

reaction forces (ground versus joint), and instrument used to assess BMD (FN only). *Post hoc*, an examination for potential differences in FN and LS BMD when partitioned according to whether studies were at a low versus unclear risk for incomplete outcome data was conducted. Because of a lack of data for categorizing, a statistical examination for other forms of bias (sequence generation, allocation concealment, blinding, selective outcome reporting) was not possible. The alpha level for statistical significance for $Q_b$ was set at $P \leq 0.05$.

*2.6.4. Metaregression.* Simple mixed-effects, method of moments metaregression was used to examine the association between changes in FN and LS BMD and selected continuous variables, assuming that at least 3$g$'s were available for each analysis. Potential predictors established *a priori* included percentage of dropouts in the exercise intervention groups, age, length, frequency and intensity of training, duration of training (aerobic exercise only), compliance to the exercise protocol, total minutes of training (unadjusted and adjusted for compliance, aerobic exercise only), number of sets, repetitions and exercises (strength training only), load rating of the exercise interventions, calculated from previous research [51], baseline BMD and changes in cardiorespiratory fitness, balance (static and dynamic), calcium intake, muscular strength (upper and lower), body weight, BMI, lean body mass, fat mass, and percent body fat. However, because of a lack of data (<3$g$'s), metaregression analysis was limited to dropouts, age, length of training, frequency of training, duration of training, compliance, unadjusted total minutes of training, adjusted total minutes of training (FN only), load rating, number of sets and exercises (FN only), changes in upper and lower body strength, bodyweight (FN only), and baseline BMD. Analyses were limited to simple metaregression versus multiple metaregression because of missing data for different variables from different studies. The alpha level for statistical significance was set at $P \leq 0.05$.

*2.6.5. Software Used for Statistical Analysis.* Data were analyzed using Comprehensive Meta-Analysis (version 2.2) [68], Microsoft Excel 2007 [56], and SSC-Stat (version 2.18) [69].

## 3. Results

*3.1. Study Characteristics.* After screening 1055 citations, seven studies representing 17 groups (10 exercise, 7 control) and 521 participants (269 exercise, 252 control) met the criteria for inclusion [14–20]. A flow diagram for the selection of studies is shown in Supplementary File 1, a general description of the characteristics of each study in Table 1, and baseline characteristics of the participants in Table 2. A list of excluded studies, including the reasons for exclusion, is available upon request from the corresponding author. For the included studies, the number of exercise groups exceeded the number of control groups because two studies included more than one exercise group [14, 17]. All studies were published in English-language journals between 1995 and 2011 [14–20]. Five studies were conducted in the United States [15, 17–20], one in Australia [14] and one in Finland [16]. For type of control groups, four studies used a nonintervention control group [16–18, 20] while three others used alternative approaches (usual care, attention control) [14, 15, 19]. With respect to matching, one study matched participants according to body weight and oral contraceptive use [16] while another matched according to age and oral contraceptive use [20]. None of the studies used a crossover design [14–20]. For sample size justification, three studies supplied power estimates to support such [14, 16, 19]. Five studies used the per-protocol approach [14, 15, 17, 18, 20] while the remaining two used intention to treat [16, 19] to analyze their data.

For external funding, five [15–17, 19, 20] of 7 studies reported receiving some type of external funding to conduct their project. The dropout rate ranged from 13.9% to 63.6% in the exercise groups ($\overline{x}$ ±SD = 40.3% ± 17.8%, Mdn = 46%) and 5.0% to 57.8% in the control groups ($\overline{x}$ ± SD = 28.5% ± 19.7%, Mdn = 28%). For the 4 studies that reported dropout data separately for exercise and control groups [14, 16, 17, 19] reasons for dropping out or being dropped in the exercise groups included changed circumstances, time constraints, injuries or pain which may or may not have been associated with the exercise intervention, personal issues, pregnancy, moving, loss of interest, uptake of medications that could affect BMD, and noncompliance with the exercise intervention. For control groups, reasons included changed circumstances, injury, moving, loss of interest, pregnancy, and uptake of medications that could affect BMD. For the one study that provided information, no serious adverse events were reported [16].

*3.2. Participant Characteristics.* Initial physical characteristics of the participants are shown in Table 2. For the three studies that reported data on race/ethnicity [15, 18, 19], participants included primarily Whites. Other racial/ethnic groups included Asians as well as Hispanics and/or Latinos. Two studies reported that none of the subjects were taking any type of hormone therapy, including hormonal contraceptives [15, 18] while the other five reported that some were [14, 16, 17, 19, 20]. For drugs other than hormone therapy that could affect BMD, two studies reported no use of such [18, 20] while one reported that some were [16]. Three studies reported that none of the participants had osteopenia or osteoporosis [15, 17, 20] while two reported no secondary osteoporosis [15, 20]. With respect to cigarette smoking, two studies reported that none of the participants were currently smoking cigarettes [16, 17]. Three studies in which data were available reported no change in the participants' levels of exercise beyond the exercise intervention itself [16, 18, 19]. Two studies reported that calcium was given to all participants [17, 18]; one reported that some participants received calcium [15] while two others reported no calcium supplementation [14, 19]. For vitamin D intake, one study reported administering vitamin D to all participants [15]

Table 1: General characteristics of studies.

| Study | Country | Participants | Exercise intervention | BMD Assessment |
|---|---|---|---|---|
| Bailey and Brooke-Wavell, 2010 [14] | United Kingdom | 85 healthy, premenopausal women 18 to 45 yrs of age assigned to 0 ($n$ = 20), 2 ($n$ = 21), 4 ($n$ = 22), or 7 ($n$ = 22) days/wk of exercise | 2, 4, or 7 days/wk of 5 sets of 10 hops on one limb with 15 seconds of walking between each set for 6 months | DEXA (GE Lunar Prodigy Advance) at the FN |
| Friedlander et al., 1995 [15] | United States | 63 women 20 to 35 yrs of age assigned to either an exercise ($n$ = 32) or stretching ($n$ = 31) group | 3 days/wk, 1 h/session, alternating classes of circuit training, strength training, and aerobic exercise (70–85% of $VO_{2\,max}$), for 2 yrs | DEXA (Hologic QDR 1000) at the LS & FN |
| Heinonen et al., 1996 [16] | Finland | 84 healthy, sedentary premenopausal women 35 to 40 yrs of age assigned to either a training ($n$ = 39) or control ($n$ = 45) group | 3 days/wk, 1 h/session (15 min warm-up, 20 min high-impact jump training, 15 min calisthenics, 10 min cool down), for 18 months | DEXA (Norland XR-26) at the LS & FN |
| Liang et al., 2011 [17] | United States | 51 healthy, untrained women 20 to 35 yrs of age assigned to a strength training ($n$ = 15), step aerobics ($n$ = 16), or control ($n$ = 20) group | 3 days/wk, 40 min/session, strength: 1–3 sets, 8–15 reps, 65–80% 1RM, 8 exercises; step aerobics: step, hop, walk, run in place, 20 cm step height, 15–300 hop cycles/session, for 12 months | DEXA (Hologic QDR 4500W) |
| Lohman et al., 1995 [18] | United States | 56 premenopausal women 28 to 39 yrs of age assigned to either an exercise ($n$ = 22) or control ($n$ = 34) group | 3 days/wk, 1 h/session, 3 sets, 8–12 reps, 70–80% 1RM, 12 weight lifting exercises, 18 months | DEXA (Lunar DPX) at the LS & FN |
| Warren et al., 2008 [19] | United States | 148 healthy, sedentary, overweight premenopausal women 25 to 44 yrs of age assigned to either an exercise ($n$ = 72) or control ($n$ = 76) group | 2 days/wk, strength training, 3 sets, 8–10 reps, for 2 yrs | DEXA (Lunar Prodigy) at the LS & FN |
| Weaver et al., 2001 [20] | United States | 55 women 18 to 31 yrs of age assigned to either an exercise ($n$ = 28) or control ($n$ = 27) group | 3 days/wk of super circuit resistance training, 8 upper and 8 lower body exercises with a cycle ergometer between each station, 8–12 reps, 70% 1RM, plus 60 min of jumping rope/wk, for 24 months | DEXA (DXA Lunar) at the LS & FN |

BMD: bone mineral density; DEXA: dual-energy X-ray absorptiometry; FN: femoral neck; LS: lumbar spine; yrs: years; min: minute(s); h: hour(s); wks: weeks; wk: week; RM: repetition maximum; reps: repetitions; $VO_{2\,max}$: maximum oxygen consumption; description of groups is limited to those that met the inclusion criteria for the current meta-analysis; description of BMD assessment is limited to the primary outcomes of the current meta-analysis (FN and LS). Number of participants is limited to those in which final BMD assessments were available.

while two others reported no administration of vitamin D [14, 19].

*3.3. Exercise Intervention Characteristics.* A description of the training program characteristics is shown in Table 1. As can be seen, the exercise interventions varied. Across all intervention groups, length of training ranged from 24 to 104 weeks ($\bar{x} \pm SD = 63.6 \pm 32.8$, Mdn = 65) while frequency ranged from 2 to 7 days per week ($\bar{x} \pm SD = 3.1 \pm 1.4$, Mdn = 3). Compliance, defined as percentage of exercise sessions attended, ranged from 44% to 90% ($\bar{x} \pm SD = 71.7\% \pm 17.7\%$, Mdn = 83%). For those groups in which data were available, four participated in either supervised or unsupervised exercise while one participated in both. For location where exercise took place, six participated in facility-based exercise, three in home-based exercise, and one did both. With respect to exercise participation, three groups participated in group-based exercise, four participated in exercise on their own, and one did both. Five exercise groups participated in ground reaction force exercise, three in joint reaction force exercise, and two in both. The exercise load rating ranged from 9.1 to 1481 ($\bar{x} \pm SD = 388.2 \pm 618.6$, Mdn = 10.1) for the nine groups that reported data for such.

*3.4. BMD Assessment Characteristics.* A description of FN and LS BMD assessment is shown in Table 1. For those studies in which data were available, three reported using Lunar dual-energy X-ray absorptiometry [14, 19, 20] while two others used a Hologic instrument [15, 17]. Coefficients of variation ranged from 0.5% to 4% at the FN and 0.3% to 4% at the LS.

*3.5. Risk of Bias Assessment.* Overall results for risk of bias are shown in Figure 1 while study level results are shown in Supplementary file 3. As can be seen, all studies were considered to be at a low risk for bias with respect to sequence generation and blinding [14–20]. In contrast, allocation concealment was categorized as unclear in 86% of the studies and low risk in 14%. Results for incomplete outcome data were mixed, with 43% considered to be at low risk for bias and 57% classified as unclear. Finally, because none of the studies provided a clinical trials registry number, selective outcome reporting was considered to be unclear for all of the studies [14–20].

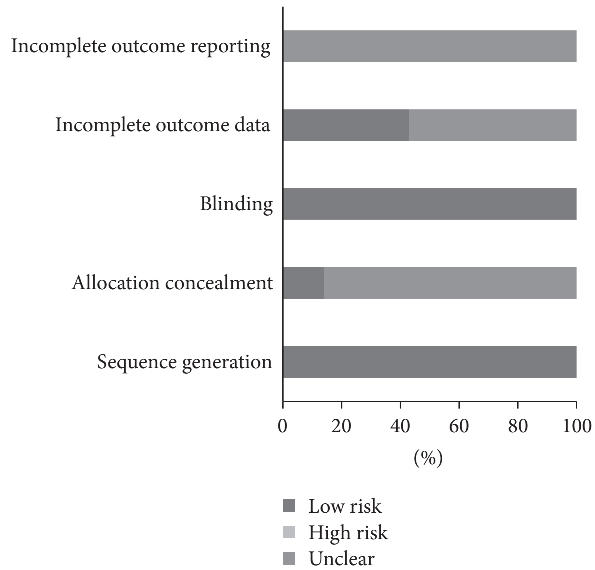


FIGURE 1: Risk of bias. Pooled risk of bias results using the Cochrane Risk of Bias Assessment Tool [57].

*3.6. Changes in Primary Outcomes*

*3.6.1. Changes in FN BMD.* Ten $g$'s representing 521 participants from seven studies [14–20] resulted in a small but statistically significant benefit in FN BMD ($g = 0.280$, 95% CI = 0.036, 0.524, $P = 0.03$, $Q = 17.8$, $P = 0.04$, $I^2 = 49.6\%$). However, one outlier was detected and deleted from all further FN BMD analyses [20]. With the one outlier deleted from the model, results remained small, statistically significant, and with a nonsignificant and small amount of heterogeneity observed (Table 3 and Figure 2). Changes were equivalent to a 1.1% benefit (0.4% increase in the exercise groups, −0.7% decrease in the control groups). The NNT was 5 while the 95% PI was −0.116 to 0.800. Statistically significant small-study effects were observed ($P = 0.05$). With each study deleted from the model once, results remained statistically significant (Figure 3). Cumulative meta-analysis demonstrated that results have been statistically significant, or there has been a trend for statistical significance, since inception of the publication of the first two studies in 1995 (Figure 4) [15, 18]. When results were collapsed so that only one $g$ represented each study, increases in FN BMD remained small, statistically significant, and with a nonsignificant and small amount of heterogeneity ($g = 0.323$, 95% CI = 0.109, 0.537, $P = 0.003$, $Q = 7.3$, $P = 0.20$, $I^2 = 31.4\%$). Because $g$ was used, no missing data for FN BMD needed to be requested from the original study authors. The calculation of $g$ was based on relative values from five studies [14–17, 20] and absolute values from the other two [18, 19]. Original metric change outcome SD's for exercise and control groups were estimated from change score SD's in three studies [15, 16, 20], one of which was transformed from sample sizes and standard errors of the means [20], 95% confidence intervals from two studies [14, 17], and initial and final standard deviations in two others [18, 19].

*3.6.2. Moderator Analysis for FN BMD.* The moderator analyses for FN BMD are shown in Supplementary File 4. As can be seen, there was a trend for greater benefits in FN BMD for those studies published in countries other than the United States. In addition, there was a trend for greater benefits in those participating in home versus facility-based exercise. No other statistically significant differences for FN BMD were observed, including when reporting of incomplete outcome data were partitioned according to low versus unclear risk ($Q_b = 0.55$, $P = 0.46$).

*3.6.3. Regression Analysis for FN BMD.* Simple metaregression results for changes in FN BMD are shown in Supplementary File 5. As can be seen, there was a statistically significant

Table 2: Initial physical characteristics of participants.

| Variable | Exercise | | | | | Control | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Groups (#) | Participants (#) | $\overline{x} \pm$ SD | Mdn | Range | Groups (#) | Participants (#) | $\overline{x} \pm$ SD | Mdn | Range |
| Age (yrs) | 10 | 269 | 30.7 ± 5.5 | 31 | 23–39 | 7 | 252 | 32.8 ± 5.2 | 34 | 24–39 |
| Body weight (kg) | 10 | 269 | 62.1 ± 8.1 | 60 | 55–82 | 7 | 252 | 65.3 ± 7.5 | 63 | 58–81 |
| BMD (g/cm$^2$) | | | | | | | | | | |
| Femoral neck | 7 | 224 | 0.927 ± 0.085 | 0.840 | 0.85–1.070 | 6 | 233 | 0.938 ± 0.105 | 0.909 | 0.840–1.090 |
| Lumbar spine | 7 | 224 | 1.118 ± 0.120 | 1.080 | 0.991–1.290 | 6 | 233 | 1.145 ± 0.138 | 1.145 | 0.986–1.30 |
| Ward's triangle | 4 | 81 | 0.882 ± 0.062 | 0.863 | 0.883–0.970 | 3 | 81 | 0.911 ± 0.082 | 0.896 | 0.833–0.970 |
| Trochanteric | 6 | 196 | 0.775 ± 0.099 | 0.735 | 0.688–0.939 | 5 | 206 | 0.786 ± 0.10 | 0.765 | 0.690–0.909 |

Groups (#): number of groups in which data were available; participants (#): number of participants nested within groups; $\overline{x} \pm$ SD: mean ± standard deviation; Mdn: median; BMD: bone mineral density.

and positive relationship between benefits in FN BMD and the number of sets performed when resistance training while an inverse relationship was observed for exercise frequency. A trend for statistical significance was observed for greater benefits in FN BMD and (1) shorter exercise interventions, (2) lower initial FN BMD, (3) increases in body weight, and (4) decreases in upper body strength.

*3.6.4. Changes in LS BMD.* Seven gs representing 457 participants from six studies [15–20] resulted in a trivial and non-significant difference in LS BMD ($g$ = 0.115, 95% CI = −0.108, 0.339, $P$ = 0.31, $Q$ = 8.5, $P$ = 0.20, $I^2$ = 29.5%). However, the same outlier as for FN BMD was detected and deleted from all further LS BMD analyses [20]. With the one outlier deleted, results were small but statistically significant and heterogeneity ($I^2$) was reduced to 0% (Table 3 and Figure 5). The NNT was 9 while the 95% PI was −0.071 to 0.473. Calculation of percent change was not possible because of missing data from two studies [16, 19]. No statistically significant small-study effects were observed ($P$ = 0.034). With each study deleted from the model once, results were no longer statistically significant or there was no longer a trend for statistical significance when two were deleted from the model (Figure 6) [15, 16]. Cumulative meta-analysis demonstrated that results have been statistically significant since inception of the second study in 1995 (Figure 7) [18]. When results were collapsed so that only one $g$ represented each study, increases in LS BMD remained small, statistically significant, and with no apparent statistical heterogeneity ($g$ = 0.201, 95% CI = 0.009, 0.394, $P$ = 0.04, Q = 3.2, $P$ = 0.52, $I^2$ = 0%). Because $g$ was used, no missing data for LS BMD needed to be requested from the original study authors. The calculation of $g$ was based on relative values from four studies [15–17, 20] and absolute values from the other two [18, 19]. Original metric change outcome SD's for exercise and control groups were estimated from change score SD's in three studies [15, 16, 20], one of which was transformed from standard errors of the means [20], 95% confidence intervals from two studies [17], and initial and final standard deviations in two others [18, 19].

*3.6.5. Moderator Analysis for LS BMD.* Moderator analyses for LS BMD are shown in Supplementary File 4. As can be seen, no statistically significant differences were observed, including when the reporting of incomplete outcome data were partitioned according to low versus unclear risk ($Q_b$ = 0.43, $P$ = 0.51).

*3.6.6. Regression Analysis for LS BMD.* Simple metaregression results for changes in LS BMD are shown in Supplementary File 5. As shown, no statistically significant associations were observed. A trend for a statistically significant association was observed for greater benefits in LS BMD and earlier published studies.

*3.7. Changes in Secondary Outcomes.* The overall results for secondary outcomes are shown in Table 3. No statistically significant differences were found for BMD at Ward's triangle and the trochanteric regions as well as for bodyweight. Small but statistically significant increases were observed for both upper and lower body strength. A trend for a statistically significant and moderate amount of heterogeneity was observed for changes in lower body strength. For both upper and lower body strength, the NNT was 4 while the 95% PI was −0.879 to 1.850 for upper body strength and −0.492 to 1.388 for lower body strength. Small-study effects were non-significant for changes in strength in both the upper ($P$ = 0.33) and lower ($P$ = 0.70) body. When results were collapsed so that only one $g$ represented each study, increases in lower body strength remained small, statistically significant, and with no apparent heterogeneity ($g$ = 0.429, 95% CI = 0.237, 0.622, $P$ = 4.37, Q = 1.4, $P$ = 0.71, $I^2$ = 0%). No study level analysis was needed for changes in upper body strength because none of the studies included multiple groups.

## 4. Discussion

The primary purpose of meta-analysis is to reach general conclusions regarding a body of research [70]. The primary purpose of this study was to use the aggregate data meta-analytic approach to determine the effects of exercise on

| Study name | Group | Statistics for each study Hedges's $g$ | Lower limit | Upper limit |
|---|---|---|---|---|
| Bailey and Brooke-Wavell, 2010 | 2 days per week | 0.269 | −0.399 | 0.937 |
| Bailey and Brooke-Wavell, 2010 | 4 days per week | 0.655 | −0.069 | 1.378 |
| Bailey and Brooke-Wavell, 2010 | 7 days per week | 1.076 | 0.365 | 1.787 |
| Friedlander et al., 1995 | None | 0.538 | 0.035 | 1.041 |
| Heinonen et al., 1996 | None | 0.379 | −0.054 | 0.812 |
| Liang et al., 2011 | Step aerobics | 0.051 | −0.607 | 0.708 |
| Liang et al., 2011 | Strength training | 0.494 | −0.185 | 1.174 |
| Lohman et al., 1995 | None | 0.224 | −0.314 | 0.762 |
| Warren et al., 2008 | None | 0.000 | −0.322 | 0.322 |
| | | 0.342 | 0.132 | 0.553 |

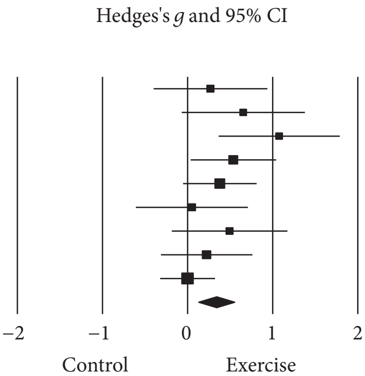


Figure 2: Forest plot for changes in FN BMD. Forest plot for point estimate standardized effect size changes ($g$) in FN BMD. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Negative results favor control groups while positive results favor exercise groups.

| Study name | Group | Statistics with study removed Point | Lower limit | Upper limit | $Z$ value | $P$ value |
|---|---|---|---|---|---|---|
| Bailey and Brooke-Wavell, 2010 | 7 days per week | 0.257 | 0.077 | 0.437 | 2.805 | 0.005 |
| Friedlander et al., 1995 | None | 0.319 | 0.087 | 0.551 | 2.697 | 0.007 |
| Bailey and Brooke-Wavell, 2010 | 4 days per week | 0.32 | 0.099 | 0.542 | 2.831 | 0.005 |
| Liang et al., 2011 | Strength training | 0.336 | 0.106 | 0.567 | 2.856 | 0.004 |
| Heinonen et al., 1996 | None | 0.349 | 0.101 | 0.597 | 2.761 | 0.006 |
| Bailey and Brooke-Wavell, 2010 | 2 days per week | 0.359 | 0.124 | 0.594 | 2.995 | 0.003 |
| Lohman et al., 1995 | None | 0.369 | 0.129 | 0.609 | 3.010 | 0.003 |
| Liang et al., 2011 | Step aerobics | 0.375 | 0.147 | 0.603 | 3.225 | 0.001 |
| Warren et al., 2008 | None | 0.432 | 0.225 | 0.639 | 4.095 | 0.000 |
| | | 0.342 | 0.132 | 0.553 | 3.187 | 0.001 |

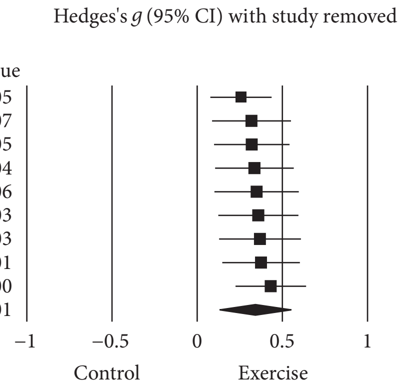


Figure 3: Influence analysis for changes in FN BMD. Influence analysis for point estimate standardized effect size changes ($g$) in FN BMD with each corresponding study deleted from the model once. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Results are ordered from smallest to largest values of $g$. Negative results favor control groups while positive results favor exercise groups.

Table 3: Changes in primary and secondary outcomes.

| Variable[a] | Studies (#) | ES (#) | Participants (#) | $\overline{x}$ (95% CI) | $Z$ ($P$) | Q ($P$) | $I^2$ (%) |
|---|---|---|---|---|---|---|---|
| Primary | | | | | | | |
| Femoral neck | 7 | 9 | 466 | 0.342 (0.132, 0.553) | **3.19 (0.001)*** | 10.8 (0.22) | 25.7 |
| Lumbar spine | 5 | 6 | 402 | 0.201 (0.009, 0.394) | **2.05 (0.04)*** | 3.3 (0.65) | 0 |
| Secondary | | | | | | | |
| Ward's triangle | 3 | 4 | 162 | 0.088 (−0.207, 0.383) | 0.59 (0.56) | 2.9(0.41) | 0 |
| Trochanteric | 7 | 10 | 521 | 0.085 (−0.097, 0.267) | 0.92 (0.36) | 10.5 (0.31) | 14.1 |
| Body weight (kg) | 5 | 5 | 296 | 0.4 (−0.5, 1.3) | 0.93 (0.35) | 2.1 (0.72) | 0 |
| Strength (upper body) | 3 | 3 | 295 | 0.49 (0.28, 0.70) | **4.56 (0.0001)*** | 1.2 (0.56) | 0 |
| Strength (lower body) | 4 | 5 | 346 | 0.45 (0.14, 0.75) | **2.88 (0.004)*** | **8.78 (0.07)**** | 54.4 |

[a]Unless noted otherwise, all outcomes are reported as standardized effect size ($g$); ES: effect size; #: number; participants (#): number of exercise and control participants nested within ES's and studies; $Z$ ($P$): $Z$ score and alpha value; $Q$ ($P$): Cochran's Q statistic and alpha value; $I^2$ (%): $I$ squared; *statistically significant ($P \leq 0.05$); **trend for statistical significance ($P > 0.05$ to $\leq 0.10$).

| Study name | Group | Cumulative statistics | | | | |
|---|---|---|---|---|---|---|
| | | Point | Lower limit | Upper limit | $Z$ value | $P$ value |
| Friedlander et al., 1995 | None | 0.538 | 0.035 | 1.041 | 2.097 | 0.036 |
| Lohman et al., 1995 | None | 0.392 | 0.024 | 0.759 | 2.09 | 0.037 |
| Heinonen et al., 1996 | None | 0.386 | 0.106 | 0.666 | 2.705 | 0.007 |
| Warren et al., 2008 | None | 0.239 | −0.006 | 0.484 | 1.911 | 0.056 |
| Bailey and Brooke-Wavell, 2010 | 2 days per week | 0.225 | 0.023 | 0.426 | 2.185 | 0.029 |
| Bailey and Brooke-Wavell, 2010 | 4 days per week | 0.259 | 0.061 | 0.456 | 2.568 | 0.010 |
| Bailey and Brooke-Wavell, 2010 | 7 days per week | 0.373 | 0.119 | 0.627 | 2.882 | 0.004 |
| Liang et al., 2011 | Step aerobics | 0.336 | 0.106 | 0.567 | 2.856 | 0.004 |
| Liang et al., 2011 | Strength training | 0.342 | 0.132 | 0.553 | 3.187 | 0.001 |
| | | 0.342 | 0.132 | 0.553 | 3.187 | 0.001 |

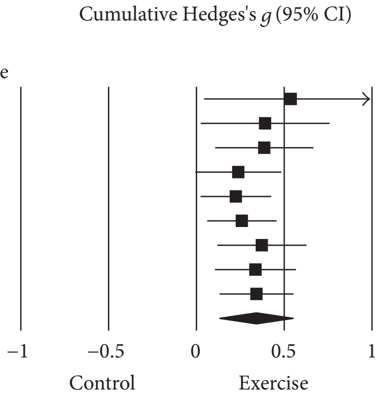


Figure 4: Cumulative meta-analysis for changes in FN BMD. Cumulative meta-analysis, ordered by year, for point estimate standardized effect size changes ($g$) in FN BMD. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The results of each corresponding study are pooled with all studies preceding it. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Negative results favor control groups while positive results favor exercise groups.

| Study name | Group | Statistics for each study | | |
|---|---|---|---|---|
| | | Hedges's $g$ | Lower limit | Upper limit |
| Friedlander et al., 1995 | None | 0.409 | −0.09 | 0.908 |
| Heinonen et al., 1996 | None | 0.323 | −0.109 | 0.754 |
| Liang et al., 2011 | Step aerobics | −0.035 | −0.693 | 0.622 |
| Liang et al., 2011 | Strength training | −0.183 | −0.854 | 0.488 |
| Lohman et al., 1995 | None | 0.381 | −0.16 | 0.921 |
| Warren et al., 2008 | None | 0.129 | −0.193 | 0.452 |
| | | 0.201 | 0.009 | 0.394 |

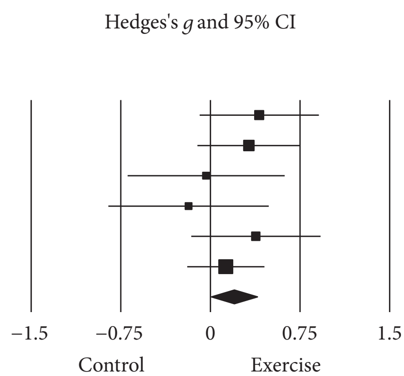


Figure 5: Forest plot for changes in LS BMD. Forest plot for point estimate standardized effect size changes ($g$) in LS BMD. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Negative results favor control groups while positive results favor exercise groups.

FN and LS BMD in premenopausal women and to examine potential moderators and predictors of such changes. To the best of the investigative team's knowledge, this is the first meta-analysis on exercise and BMD in premenopausal women limited to randomized controlled trials. The overall findings suggest that exercise results in small, as defined by Cohen's categorization for the magnitude of effect for $g$ [60], but statistically significant benefits in both FN and LS BMD. These findings are similar to the statistically significant results reported for LS BMD in two earlier meta-analyses but differ with respect to FN BMD [37, 44]. One possible reason for the lack of statistically significant findings for FN BMD in the two previous meta-analyses may have to do with the small number of results that were pooled. Specifically, one meta-analysis pooled results from three randomized controlled trials [44] while a second pooled results from five randomized controlled trials [37]. A second possible reason may have to do with the differing inclusion criteria across meta-analyses. In contrast, the overall findings of the current investigation are in agreement with the overall findings of the James and Carroll meta-analysis [41].

To the best of the investigative team's knowledge, this is the first meta-analysis to report NNT for exercise and BMD studies in premenopausal women. The current findings suggest that less than 10 women would need to exercise in order to derive benefit in BMD at the FN and LS. However, whether the magnitude of effect is large enough to reduce the risk of site-specific fractures in those women who improve their FN and LS BMD is not known.

While the exercise-induced benefits observed for FN and LS BMD were considered small and statistically significant, the direct clinical importance of such changes is

| Study name | Group | Statistics with study removed | | | | |
|---|---|---|---|---|---|---|
| | | Point | Lower limit | Upper limit | $Z$ value | $P$ value |
| Friedlander et al., 1995 | None | 0.165 | −0.044 | 0.374 | 1.55 | 0.121 |
| Heinonen et al., 1996 | None | 0.171 | −0.044 | 0.387 | 1.56 | 0.119 |
| Lohman et al., 1995 | None | 0.175 | −0.031 | 0.382 | 1.668 | 0.095 |
| Liang et al., 2011 | Step aerobics | 0.224 | 0.022 | 0.425 | 2.176 | 0.030 |
| Liang et al., 2011 | Strength training | 0.236 | 0.035 | 0.437 | 2.300 | 0.021 |
| Warren et al., 2008 | None | 0.241 | 0.001 | 0.482 | 1.971 | 0.049 |
| | | 0.201 | 0.009 | 0.394 | 2.050 | 0.040 |

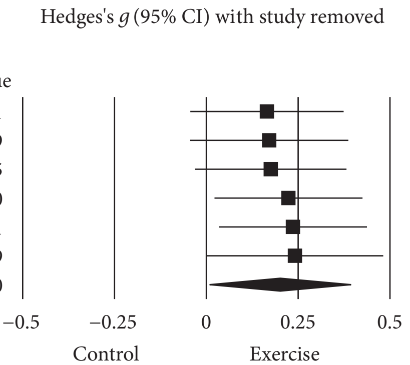


Figure 6: Influence analysis for changes in LS BMD. Influence analysis for point estimate standardized effect size changes ($g$) in LS BMD with each corresponding study deleted from the model once. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Results are ordered from smallest to largest values of $g$. Negative results favor control groups while positive results favor exercise groups.

| Study name | Group | Cumulative statistics | | | | |
|---|---|---|---|---|---|---|
| | | Point | Lower limit | Upper limit | $Z$ value | $P$ value |
| Friedlander et al., 1995 | None | 0.409 | −0.09 | 0.908 | 1.606 | 0.108 |
| Lohman et al., 1995 | None | 0.396 | 0.029 | 0.763 | 2.115 | 0.034 |
| Heinonen et al., 1996 | None | 0.365 | 0.086 | 0.645 | 2.561 | 0.010 |
| Warren et al., 2008 | None | 0.264 | 0.053 | 0.475 | 2.450 | 0.014 |
| Liang et al., 2011 | Step aerobics | 0.236 | 0.035 | 0.437 | 2.300 | 0.021 |
| Liang et al., 2011 | Strength training | 0.201 | 0.009 | 0.394 | 2.050 | 0.040 |
| | | 0.201 | 0.009 | 0.394 | 2.050 | 0.040 |

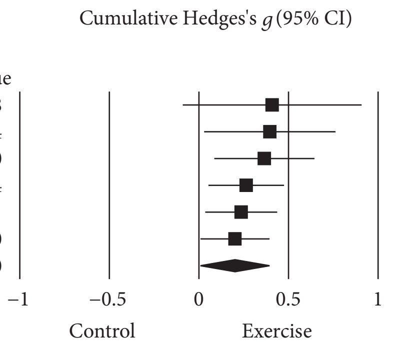


Figure 7: Cumulative meta-analysis for changes in LS BMD. Cumulative meta-analysis, ordered by year, for point estimate standardized effect size changes ($g$) in LS BMD. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The results of each corresponding study are pooled with all studies preceding it. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Negative results favor control groups while positive results favor exercise groups.

not known. Previous meta-analytic work in postmenopausal women reported that a 1% improvement in spine BMD was associated with a small but statistically significant 0.03 decrease in the relative risk of vertebral fracture as a result of antiresorptive therapy [71]. However, this study was limited to postmenopausal women using antiresorptive agents. Since the effects of exercise on BMD may be different from antiresorptive therapy, these findings may need to be interpreted with caution when applied to exercise. While additional research is needed, it would seem plausible that any exercise-induced benefit on FN and LS BMD in premenopausal women might be beneficial, especially when viewed from a population-wide perspective.

While the overall results suggest that exercise benefits FN and LS BMD in premenopausal women, these findings should be viewed with respect to several factors. First, the 95% PI for treatment effects if a new trial was conducted crossed zero (0) for both FN and LS BMD. It has been suggested that nonoverlapping PI allows for more robust meta-analytic conclusions [64]. Second, small-study effects were observed for ES changes in FN BMD. This suggests that ES benefits may be inflated. Third, influence analysis for ES changes in LS BMD resulted in $P$ values $> 0.10$ when two studies were deleted separately from the model. This suggests a possible lack of robustness across studies. Finally, while BMD has been shown to account for approximately 60% to 70% of the variation in bone strength, it does not account for other aspects of bone quality such as microarchitecture [72, 73]. Thus, the potential benefits of effects of exercise on bone strength, when limited to BMD, may be underestimated. However, a recent systematic review with meta-analysis was only able to locate one randomized controlled trial addressing the effects of exercise on bone outcomes other than BMD (bone strength index, stress-strain index, maximal moment of inertia, cross-sectional moment of inertia, and section moduli) in premenopausal women [74]. Overall,

no statistically significant effect of a 12-month progressive impact exercise program was found at the proximal tibia and femoral shaft [75]. However, greater compliance was associated with improvements ranging from 0.5% to 2.5% at the proximal tibia [75]. Clearly, additional well-designed randomized controlled trials are needed to address the effects of exercise on bone outcomes other than BMD.

Moderator analyses resulted in a trend for greater benefits on FN BMD when exercise took place in the home versus a facility. Since the investigative team is not aware of any consensus in the literature regarding which location is superior, future research in this area appears warranted. In addition to several other non-significant findings, no statistically significant differences were observed when data were partitioned according to type of exercise as well as type of reaction forces induced by exercise.

In subgroup analyses, a recent meta-analysis by James and Carroll reported changes in FN and LS BMD for high-impact only protocols as well as combined impact/resistance training protocols in premenopausal women [41]. A significant improvement in FN but not LS was found as a result of high-impact protocols while combined impact/resistance training resulted in significant improvements in LS but not FN BMD [41]. When limited to ground reaction force exercise, the results of the current meta-analysis are similar to the high-impact protocol results of James and Carroll [41] (FN, $g = 0.454$, 95% CI = 0.143, 0.764, $P = 0.004$; LS, $g = 0.215$, 95% CI = −0.146, 0.576, $P = 0.243$). However, because of the small sample size, investigators in the current meta-analysis were unable to perform subgroup analyses for combined ground and joint reaction force exercise. While these findings are interesting, it is probably not appropriate to make a decision about whether ground and joint reaction force exercise studies should be pooled based on running separate analyses for each. The primary reasons for this include the small sample sizes as well as the inability to control for other potentially confounding variables. Rather, these potential differences would need to be tested in well-designed randomized controlled trials.

Simple metaregression analyses resulted in several noteworthy associations that may be appropriate for future investigation. Specifically, there was a trend for greater increases in FN BMD with shorter exercise interventions as well as a statistically significant association between increases in FN BMD and fewer days per week of exercise. One possible explanation for the negative associations observed may have to do with the loss of calcium from excessive exercise [76, 77]. This causes a decrease in serum calcium, followed by an increase in serum parathyroid hormone, which then stimulates bone resorption [76, 77]. However, no association was observed between changes in FN BMD and duration of training as well as exercise load rating. Thus, while these findings are interesting, further dose-response research is needed before any firm conclusions can be drawn. For resistance training, greater increases in FN BMD were associated with a greater number of sets. Since sweating as a result of resistance training is usually not as great as that from aerobic exercise, it may be that a greater but undetermined amount of resistance training is needed to increase FN BMD in premenopausal women. However, no association was found between the number of exercises performed and changes in FN BMD. Given the former, it would appear appropriate to suggest that future dose-response studies are needed to address this issue. Until that time, it would appear plausible to suggest adherence to current exercise guidelines for optimizing BMD in adults [78].

The trend for greater benefits in FN BMD and lower baseline BMD at the FN suggests that those with lower FN BMD may derive the greatest benefits as a result of exercise. This finding would seem to be entirely reasonable. The trend for increases in FN BMD to be associated with increases in body weight supports well-established research regarding greater BMD in heavier adult humans. Other than chance, the investigative team has no plausible explanation for the observed association between increases in FN BMD and smaller increases in upper body strength. Finally, there was a trend for greater benefits in LS BMD for those studies published during the earlier years. This observed association may be reflective of improved study designs in more recent years.

While the results for moderator and regression analyses are interesting, they should be viewed with respect to the following potential limitations. First, because of missing data for different variables from different studies, multiple metaregression analysis was not performed. Thus, controlling for potential confounding factors was not possible. Second, because of the large number of statistical tests conducted, one or more of the significant findings may have been nothing more than the play of chance. However, no adjustment was made for alpha values because such adjustments tend to be overly conservative [79]. In addition, the investigative team did not want to miss any potentially important findings that might be worthy of further investigation [79]. Third, since potential moderators and predictors are not randomly assigned in meta-analysis, such analyses are considered to be observational [80]. Therefore, causal inferences cannot be derived [80]. However, such differences and associations do provide direction for future research.

For secondary outcomes, statistically significant increases in both upper and lower body strength were observed. This suggests that exercise, particularly resistance training exercise, can improve both upper and lower body strength in premenopausal women. This observation demonstrates two of the many benefits that can be derived from a regular exercise program [81]. However, results for secondary outcomes in any meta-analysis need to be interpreted with caution since the inclusion of such are not mandatory for inclusion in a meta-analysis. Thus, secondary outcomes may represent a potentially biased sample of results.

Several suggestions in relation to the conduct and reporting of future randomized controlled trials on the effects of exercise in premenopausal women appear appropriate.

The first issue has to do with the risk of bias findings. For example, while all of the studies were considered to be at a low risk of bias with respect to randomized sequence generation, all but one study [15] was considered to be at an unclear risk for adequate allocation concealment. While randomized sequence generation is important, it might be

ineffective if it is not protected by adequate concealment of the allocation from those responsible for enrolling and assigning participants [82]. To support this contention, Pildal et al. [83] reported that binary effect estimates from randomized controlled trials with inadequate allocation concealment were approximately 18% more beneficial than estimates from trials with adequate concealment. However, a more specific analysis by Wood et al. [84] found that intervention effect estimates were inflated when inadequate allocation concealment was present in trials with a subjective outcome but not when the outcome was objective. Given that the primary outcomes in the current meta-analysis were objective measures, that is, changes in FN and LS BMD, inadequate sequence generation may not have posed much of a threat. Notwithstanding the former, it would still seem plausible to suggest that future studies perform appropriate allocation concealment procedures and report this information in their published work.

Because of the objective nature of BMD assessment, all studies were considered to be at a low risk of bias for blinding. While this may indeed be the case, it is also possible that such a classification may not have been appropriate. For example, Pildal et al. [83] reported that a lack of blinding in randomized controlled trials was associated with exaggerated odds ratios averaging 9%. However, this potential form of bias has been reported to be greater for trials with more subjective versus objective outcomes [84]. Thus, blinding as a potential form of bias may not have posed much of a threat in the current meta-analysis. This is important since it is extremely difficult to adequately blind participants enrolled in exercise intervention studies. Regardless, it would seem appropriate to recommend that investigators do the best that they can to blind all relevant parties to group assignment.

Incomplete (missing) outcome data due to drop outs during a study and/or exclusions from a study may result in biased effect estimates [82]. For the current meta-analysis, three studies were considered to be at a low risk for bias [15, 16, 19] while four were classified as unclear risk [14, 17, 18, 20]. However, since no statistically significant differences between the two were found for changes in FN and LS BMD, this potential form of bias did not seem to have an effect in the current meta-analysis.

Selective outcome reporting may be considered as a subset of findings that are reported based on their results [85]. The major concern is that results which are not statistically significant may be withheld. As a result, meta-analyses may overestimate treatment effects. To support this potential form of bias, at least three studies have shown that outcomes with statistically significant findings are more likely to be reported than outcomes with non-significant results [86–88]. For the current meta-analysis, all of the studies were classified as being at an unclear risk of bias for selective outcome reporting. This was based on the fact that none of the studies provided a clinical trials registry number so that the investigative team could retrieve and review the original study protocol. Given the inability to determine such, this potential form of bias cannot be ruled out for the current meta-analysis. It is strongly suggested that future studies report their clinical trials registry number so this potential form of bias can be determined. However, recent research by Hartling et al. [89], has suggested that the search and identification for study protocols to assess selective outcome reporting bias may not be feasible or productive. Given the former, they suggest that in the absence of study protocols that the outcomes reported in the methods section of a paper should be compared with those reported in the results [89].

Future randomized controlled trials should also report more detailed information, by group, for race/ethnicity, dropouts, adverse events, cigarette smoking, alcohol consumption, pharmacological intake, parental history of osteoporosis and fractures, changes in physical activity habits outside the exercise intervention as well as baseline and final changes in cardiorespiratory fitness, static and dynamic balance, calcium and vitamin D levels, fat mass, and lean body mass. In addition, it is suggested that future studies analyze and report data using both per-protocol and intention-to-treat analyses. This would allow one to determine both the efficacy (per-protocol analysis) and effectiveness (intention-to-treat analysis) of exercise on FN and LS BMD in premenopausal women.

## 5. Conclusions

The primary and accomplished aim of this study was to use the meta-analytic approach to determine the overall effects of ground and joint reaction exercise on FN and LS BMD in premenopausal women when limited to randomized controlled trials. The overall findings of the current meta-analysis provide additional support regarding the benefits of exercise, including NNT estimates to aid decision makers regarding the utility of exercise for improving FN and LS BMD in premenopausal women. In addition, this study provides first-time meta-analytic evidence, when limited to randomized controlled trials, of potential moderators and predictors with respect to changes in FN and LS BMD, which appears worthy of pursuing in future well-designed randomized controlled trials. The inability of the current meta-analysis to provide a definitive exercise prescription warrants further research. In addition, the results should be interpreted with some trepidation given that the quality of evidence could be improved.

## Acknowledgment

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Original Full Length Article

# Exercise and bone mineral density in men: A meta-analysis of randomized controlled trials

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ABSTRACT

*Objective:* Use the meta-analytic approach to examine the effects of ground and/or joint reaction force exercise on femoral neck (FN) and lumbar spine (LS) bone mineral density (BMD) in men.
*Methods:* Randomized controlled exercise trials ≥24 weeks were included. Standardized effect sizes ($g$) were calculated and pooled using random-effects models, $z$-score alpha values and 95% confidence intervals (CI). Heterogeneity was examined using Q and $I^2$. Statistical significance was set at a two-tailed alpha value ($p$) of ≤0.05 and a trend at >0.05 to ≤0.10.
*Results:* A moderate and statistically significant improvement was found at the FN (3 $g$'s, 187 participants, $g=0.583$, 95% CI $=0.031$, 1.135, $p=0.04$, Q $=5.6$, $p=0.06$, $I^2=64\%$) while a small trend was observed at the LS (5 $g$'s, 275 participants, $g=0.190$, 95% CI $=-0.036$, 0.416, $p=0.10$, Q $=3.0$, $p=0.55$, $I^2=0\%$). Results were sensitive to influence analysis as well as collapsing multiple groups from the same studies so that only one $g$ represented each study.
*Conclusions:* There is currently insufficient evidence to recommend ground and/or joint reaction force exercise for improving and/or maintaining FN and LS BMD in men. Additional well-designed randomized controlled trials are needed before any final recommendations can be formulated.


## Introduction

Low bone mass (osteopenia) and osteoporosis increase the risk for fracture. For example, it has been estimated that the worldwide incidence of osteoporosis-related fractures is 8.9 million per year, about one every 3 s [1]. The two most common sites for osteoporosis-related fracture are the hip and spine [1].

While the prevalence of osteopenia and osteoporosis is more common in women than men [2], the burden of this problem among men is still substantial. For example, recent data from the US National Center for Health Statistics reported that the age-adjusted prevalence of osteopenia among US men 50 years of age and older was 38% while the age-adjusted prevalence for osteoporosis was 4% [2]. Using the 2010 population estimates from the US Census Bureau [3], this means that approximately 16.8 million US men 50 years of age and older currently have osteopenia while more than 1.7 million have osteoporosis. In addition, fracture-related mortality rates are higher in men than women [4]. For example, men with hip fractures have mortality rates that are two to three times higher than women [5–7]. The issue of fracture-related mortality in men is especially important given that the lifetime risk for any osteoporotic fracture has been estimated to be between 13% and 22% in men 50 years of age and older [8] and 42% in osteoporotic men 60 years of age and older [9]. To compound this problem, it is estimated that by the year 2025, the worldwide incidence of hip fractures occurring in men will increase from 0.5 million in 1990 [10] to 1.16 million in 2025 [11].

Maintaining optimal bone mineral density (BMD) levels in men during the adult years is important for reducing the risk of fracture. While men traditionally reach peak spine BMD by the age of 18 years and peak hip BMD several years later [12], bone loss during the adult years occurs as a result of bone resorption exceeding formation, with reported estimates between 0.5% and 1.0% per year starting as early as 30 years of age [13–16]. One potential, low-cost, readily available non-pharmacologic approach for maintaining optimal BMD levels in men is exercise. Unfortunately, while some consider systematic reviews with meta-analysis as the highest level of evidence for reaching decisions regarding the effectiveness of an intervention on an outcome [17], especially when limited to randomized controlled trials [18], the investigative team is aware of only one meta-analysis, conducted more than a decade ago, focused on the effects of exercise on BMD in men [19]. Included in the meta-analysis were 6 controlled trials and

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only 2 randomized controlled trials in which BMD was assessed at any region [19]. While the results were not statistically significant, the overall benefits of exercise were approximately 2%; a 1.6% increase among exercisers and a 0.4% decrease in controls [19]. When partitioned according to age, a statistically significant benefit of 6.7% (4.2% increase in exercisers, 2.5% decrease in controls) was found in men > 31 years of age with no difference in men ≤31 years of age [19]. In addition, a statistically significant benefit of 10.7% (5.8% increase in exercisers, 4.9% decrease in controls) was observed at the lumbar spine (LS) as well as a 5% benefit at the femur (4.0% increase in exercise groups, 1.9% decrease in controls) [19]. While statistically significant benefits were observed, both randomized and nonrandomized controlled trials were included with only two of the eight studies (25%) reported as randomized controlled trials [19]. In addition, results for the femur were pooled across all femur sites assessed, not just the femoral neck (FN) [19]. The inclusion of nonrandomized controlled trials is potentially problematic because randomized controlled trials are the only way to control for confounders that are not known or measured and nonrandomized controlled trials tend to overestimate the effects of healthcare interventions [20,21]. In addition, since the FN is the most common hip fracture site [22], a focus on this location versus all hip sites combined is important. Furthermore, since this study was conducted more than a decade ago and the median time before a meta-analysis should be updated has been estimated at 5.5 years [23], this work is in need of updating. Given the former, the purpose of this study was to use the aggregate data meta-analytic approach to examine the effects of exercise on FN and LS BMD in men.

## Methods

### Study eligibility criteria

The a priori inclusion criteria for studies were as follows: (1) randomized trials with a comparative control group (non-intervention, usual care, attention control), (2) men 18 years of age and older, (3) participants not taking part in regular exercise prior to study enrollment, (4) ground and/or joint reaction force exercise intervention of at least 24 weeks, (5) published and unpublished (master's theses and dissertations) studies since January 1989, and (6) data available for changes in FN and/or LS BMD as assessed by dual-energy X-ray absorptiometry (DEXA) or dual-photon absorptiometry (DPA). Studies not meeting all of the above criteria were excluded. Based on exercise-induced changes in BMD, studies were limited to those in which the exercise intervention lasted at least 24 weeks [24]. Since the investigative team was interested in the independent effects of exercise on FN and LS BMD, studies with multiple interventions, for example exercise and milk, were included as long as there was an adequate comparison group, for example, milk only [25]. Resistance training studies were limited to those that included lower body exercise. The year 1989 was chosen as the start date for inclusion since it appeared to be the first time that a randomized controlled trial on exercise and BMD in adult humans was conducted [26].

### Data sources

Studies were identified from a large, previously developed reference database that included 1055 exclusive citations (Fig. 1). Records for the original reference database were retrieved from six electronic sources (PubMed, Embase, SportDiscus, Cochrane Central Register of Controlled Clinical Trials, CINAHL, Dissertation Abstracts International). In addition, cross-referencing from retrieved studies, including previous reviews was conducted. Furthermore, hand searching of selected journals took place. A list of journals that were hand searched is available upon request from the corresponding author. Keywords relevant to all searches included various forms of the following: “exercise”, “bone” and “randomized”. All searches were conducted by the second author with assistance from a Health Sciences librarian at West Virginia University, The last search was conducted in August of 2011. Based on the recent Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines [27], an example of the search strategy used for one of the electronic databases is shown in Supplementary File 1.

### Study selection

Potentially eligible studies were selected autonomously by the first two authors. They then met and reviewed all selections for accuracy. Differences were resolved by consensus. If consensus could not be reached, the third author served as a conciliator. In addition, the final list of selected studies was reviewed for thoroughness and comprehensiveness by the third author, an expert on exercise and BMD. A list of included and excluded studies, including the reasons for exclusion, was stored in Reference Manager, version 12.0.1 [28].

### Data abstraction

Prior to data abstraction electronic codebooks were developed using Microsoft Excel 2007 [29]. All codebooks were created by the first author with contributions from the second and third authors. Every codebook was then reviewed and tested by all authors. Codebooks were then modified by the first author and reviewed and tested by all authors until final codebooks for data abstraction were available after three iterations. The main categories of variables coded were (1) study characteristics (journal, risk of bias assessment, etc.), (2) group characteristics (age, bodyweight, etc.) and (3) outcome characteristics (changes in FN and LS BMD, secondary outcomes, etc.). All codebooks could retain up to 324 items from each study.

The a priori primary outcomes for this study were changes in FN and LS BMD. Secondary a priori outcomes included changes in other BMD sites (whole body, Ward's triangle, intertrochanter, trochanter, total hip, radius, ulna, calcaneus, os calcis), body weight, body mass index (BMI), lean body mass (LBM), percent body fat, fat mass, muscular strength (upper and/or lower), muscular power, cardiorespiratory fitness, balance (static and dynamic), calcium intake, vitamin D intake and fractures. The exercise load rating for each exercise group from each study was calculated using the product of vertical ground reaction force and rate of force application as described by Weeks and Beck [30].

All data were abstracted by the first two authors, independent of each other. They then met and reviewed every selection for correctness. Differences were resolved by discussion. If agreement could not be reached, the third author served as a conciliator. Missing data from one study that met all inclusion criteria was requested and successfully obtained [25].

### Risk of bias assessment

Risk of bias was assessed using the Cochrane risk of bias assessment tool [31]. Briefly, risk of bias is assessed as either low risk, high risk, or unclear risk in five primary areas: (1) sequence generation, (2) allocation concealment, (3) blinding of participants, personnel and outcome assessors, (4) incomplete outcome data, and (5) selective outcome reporting. Given the objective nature of BMD assessment, all studies were considered to be at a low risk of bias with respect to blinding. Risk of bias for selective outcome reporting was coded as “low risk” only if the study reported a study protocol identification number [32]. All risk of bias assessments were conducted by the first two authors, independent of each other. They then met and reviewed every item for agreement. Disagreements were resolved by consensus.

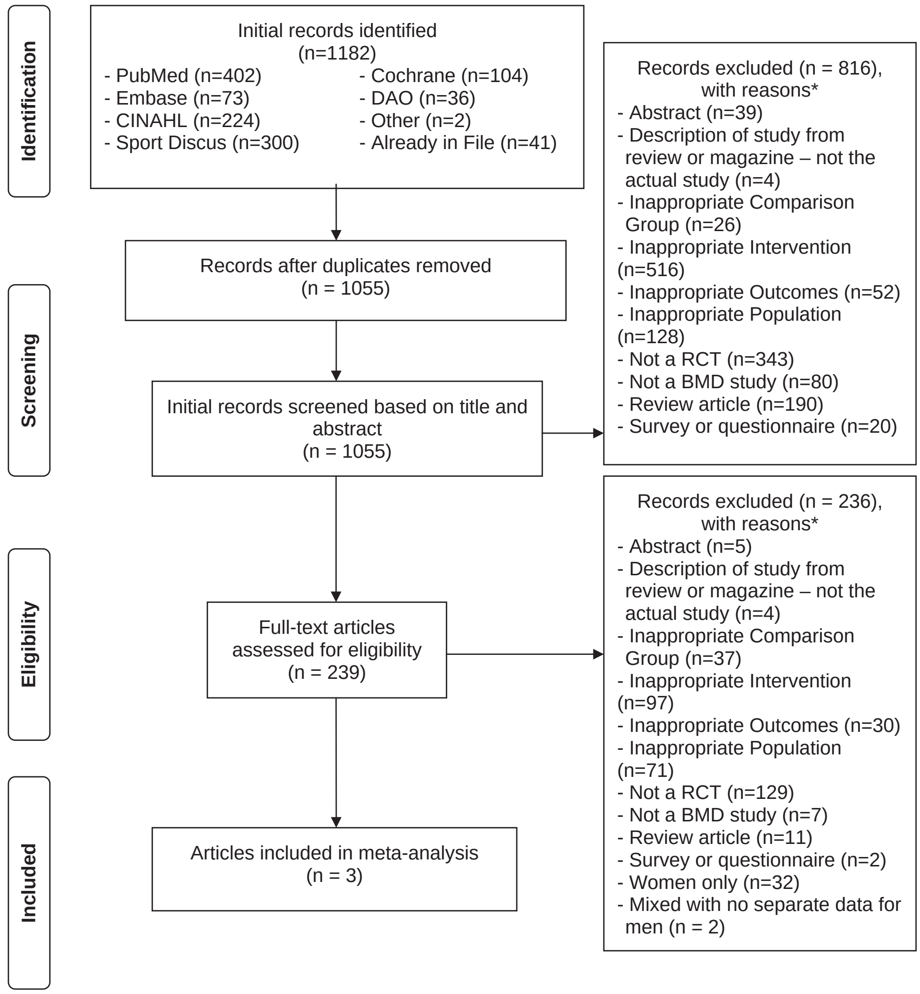


**Fig. 1.** Flow diagram for the selection of studies. *, number of reasons exceeds the number of studies because some studies were excluded for more than one reason.

### *Statistical analysis*

#### *Calculation of effect sizes from each study*

The a priori primary outcomes for this meta-analysis were changes in FN and LS BMD. These were calculated using the standardized effect size (ES) *g* [33]. The *g* was chosen over the original metric because of the different methods used to report data, specifically, absolute versus relative changes in BMD as well as the variability in assessing BMD across different studies. The *g* for each group from each study was calculated as the change score difference (absolute or relative) in the exercise group minus the change score difference in the control group, divided by the pooled standard deviation of the exercise and control groups. The variance for each *g* was calculated from final sample sizes using traditional procedures [33]. All g's were corrected for small sample bias [33].

The a priori secondary outcomes included changes in BMD at any site other than the FN and LS as well as changes in body weight in kilograms, BMI in kg/m$^2$, LBM, percent body fat, muscular strength (lower and upper), muscular power, cardiorespiratory fitness, balance (static and dynamic), calcium, vitamin D intake and fracture risk. However, because of a lack of data (<2 studies and/or <3 total *g*'s per outcome), meta-analysis of secondary outcomes was limited to changes in total hip BMD, body weight and BMI. For total hip BMD, *g* was calculated using the same procedures as for our primary outcomes, FN and LS BMD. For body weight and BMI the original metric ES for each group from each study was calculated by subtracting the change score difference in the exercise group from the change score difference in the control group. Variances were calculated from the pooled standard deviations of change scores in the intervention and control groups.

#### *Effect size pooling*

All ESs were pooled using a random-effect, method of moments model [34]. This approach weights studies by the inverse of the variance and incorporates heterogeneity into the model [34]. For both primary and secondary outcomes, pooling was limited to those outcomes with a minimum of 3 ESs from at least 2 studies. Multiple groups from the same study were analyzed both independently and with multiple groups collapsed so that only one ES represented each outcome from each study. For *g*, the magnitude may be considered as trivial (<0.20), small (≥0.20 to <0.50), medium (≥0.50 to <0.80), or large (≥0.80) [35]. A two-tailed *z*-score alpha value of ≤0.05 was considered statistically significant while alpha values >0.05 but ≤0.10 were considered as a trend. Precision was determined using two-tailed 95% confidence intervals (CIs). For outcomes with statistically significant results or a trend for statistically significant results, estimation of treatment effects in a new trial was calculated using 95% prediction intervals (PI) [36–38]. Analysis of secondary outcomes was considered exploratory because they were not part of the inclusion criteria, and thus, may represent a biased sample. After initial pooling, any outcomes with statistically significant residuals, i.e., outliers ($p \leq 0.05$) were deleted from all further analysis.

Heterogeneity of pooled results based on fixed-effect models were examined using the Q statistic and $I^2$, an extension of Q that more accurately reflects heterogeneity [39]. The alpha value for statistical significance for Q was set at $p \leq 0.10$. For $I^2$, values of 25% to <50% may be considered small, 50% to <75% medium, and ≥75% large [39]. Potential bias due to small-study effects was examined using the approach of Duval and Tweedie [40,41]. For FN and LS BMD, influence analysis was conducted in order to examine the effects of each ES on the overall results.

*Moderator and meta-regression analyses*

Given the small number of ES's for each outcome, no moderator or meta-regression analyses were performed.

*Software used for statistical analysis*

All data were analyzed using Comprehensive Meta-Analysis (version 2.2) [42], Microsoft Excel 2007 [29] and SSC-Stat (version 2.18) [43].

## Results

*Study characteristics*

Of the 1055 citations reviewed, three studies representing nine groups (five exercise and four control) and up to 275 participants (152 exercise, 123 control) met all eligibility criteria [25,44,45]. The number of groups exceeded the number of studies because two studies included more than one intervention group [25,44]. A flow diagram that describes the selection of studies is shown in Fig. 1 while a general description of the included studies is shown in Table 1. A list of excluded studies, including the primary reason(s) for exclusion, is available upon request from the corresponding author.

Two of the included studies were dissertations [44,45] while the other was published in a peer-reviewed journal [25]. All three were published in the English-language starting with the year 2004 and ending in 2011 [25,44,45]. One study was conducted in the United States [45], one in Australia [25] and one in China [44]. Prior to randomization, one study matched participants by age and calcium intake [25] while another matched according to gender [44]. However, since the focus of this meta-analysis was on men, data for women were not included. The maximum number of men in which final BMD assessment was available in each group from each study ranged from 6 to 44 in the exercise groups (mean ± SD, 30 ± 15, Mdn, 30) and 9 to 43 in the controls (mean ± SD, 31 ± 16, Mdn, 36). None of the studies used a crossover design. All three studies provided sample size estimates [25,44,45].

*Participant characteristics*

A description of the baseline characteristics of participants is shown in Tables 1 and 2.

Within-study ages ranged from 41 to 79 years in the exercise groups and 50 to 79 years in controls. Dropouts ranged from 0% to 12.5% in the exercise intervention groups (mean ± SD, 4.9% ± 4.6%, Mdn, 4.3%) and 3.3% to 10.0% in the controls (mean ± SD, 5.6% ± 3.0%, Mdn, 4.5%). The primary reason for dropping out was time constraints. Other reasons included moving as well as dissatisfaction with participation in the study. No serious adverse events were reported. For those studies in which race/ethnicity information was available, one was limited to Asian participants [44] while another was limited to Whites [25]. Two of the studies reported that none of the participants were taking any type of drugs that could affect bone metabolism [25,45]. None of the studies appeared to include participants who had osteoporosis [25,44,45]. However, one study did include some participants with osteopenia [25]. For cigarette smoking, one study reported that some participants smoked cigarettes [44] while another reported that none did [25]. With respect to alcohol consumption, one study reported that none of the participants in the control and one exercise group consumed alcohol while some reportedly consumed alcohol in another exercise group [44]. No change in exercise habits beyond the actual exercise intervention was reported by one study [25]. For calcium and vitamin D intake, two groups from two studies received supplemental calcium and vitamin D [25,45] while one group from one study did not receive any type of calcium and vitamin D supplementation [25]. One study reported that none of the participants had a history of fractures prior to study entry [25].

*Exercise intervention characteristics*

A general description of the exercise interventions is provided in Table 1. As can be seen, the exercise modalities varied both within and between studies. Length of exercise training took place 3 times per week for 32 to 72 weeks (mean ± SD, 56 ± 17 weeks, Mdn, 52 weeks). Compliance ranged from 63% to 96% (mean ± SD, 72.4% ± 14.5%, Mdn, 63%). Three groups participated in supervised exercise while one group each participated in combined supervised and unsupervised exercise or unsupervised exercise only. For location, three groups participated in facility-based exercise while one group each participated in either home and facility-based exercise or home-based exercise only. Load ratings for the exercise interventions ranged from 10 to 1375 (mean ± SD, 556.0 ± 747.6, Mdn, 10).

**Table 1**
General characteristics of included studies.

| Study | Country | Participants | Exercise intervention | BMD assessment |
|---|---|---|---|---|
| Hong [44] | China | 82 healthy men 65 to 74 yrs of age assigned to a Tai Chi (n = 26), resistance training (n = 27, or control (n = 29) group | 3 days/wk: Tai Chi: Yang style, 24 forms, 45 min; Resistance Training: 1 set, 30 reps, 7 exercises, Therabands used for resistance; for 12 months | DEXA (Hologic QDR 4500 Elite) at the FN & LS |
| Kukuljan et al. [25] | Australia | 176 healthy men 50 to 79 yrs of age assigned to an exercise (n = 46), exercise + milk (n = 43), control (n = 44) or milk (n = 43) group | 3 days/wk, 60–75 min/session, Resistance Training: 2–3 sets, 8–20 reps, 50–85% 1RM, 6–8 exercises plus 3 moderate-impact weight-bearing exercises (jumping & stepping) in between resistance exercises 3 sets of 10–20 reps, for 18 months | DEXA (GE Lunar Prodigy) at the FN & LS |
| Zeilman [45] | United States | 16 sedentary men with irritable bowel syndrome 41 to 75 yrs of age assigned to either an exercise (n = 7) or control (n = 9) group | 3 days/wk, 50 min/session, stretching, flexibility calisthenics & walking with weighted vests and a pedometer, for 32 wks | DEXA (Lunar Prodigy) at the FN & LS |

Notes: BMD, bone mineral density; DEXA, dual-energy X-ray absorptiometry; FN, femoral neck; LS, lumbar spine; yrs, years; min, minute(s); wks, weeks; wk, week; RM, repetition maximum; reps, repetitions; description of groups limited to those that met the inclusion criteria for the current meta-analysis; description of BMD assessment limited to the primary outcomes of the current meta-analysis (FN and LS). Number of subjects limited to those in which final BMD assessments were available.

**Table 2**
Initial physical characteristics of participants.

| Variable | Exercise | | | | | Control | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Groups (#) | Participants (#) | Mean ± SD | Mdn | Range | Groups (#) | Participants (#) | Mean ± SD | Mdn | Range |
| Age (yrs) | 5 | 152 | 62.0 ± 7.4 | 62 | 51–69 | 4 | 123 | 62.3. ± 4.0 | 61 | 59–68 |
| Body weight (kg) | – | – | – | – | – | – | – | – | – | – |
| BMI (kg/m$^2$) | 3 | 65 | 26.4 ± 4.4 | 24 | 23.6–31.4 | | | | | |
| BMD (g/cm$^2$) | | | | | | | | | | |
| Femoral neck | 3 | 93 | 0.907 ± 0.040 | 0.922 | 0.862–0.938 | 3 | 94 | 0.926 ± 0.007 | 0.927 | 0.919–1.933 |
| Lumbar spine | 5 | 152 | 1.105 ± 0.135 | 1.106 | 0.950–1.247 | 4 | 123 | 1.158 ± 0.133 | 1.218 | 0.960–1.238 |
| Total hip | 5 | 146 | 0.914 ± 0.109 | 0.890 | 0.774–1.026 | 4 | 123 | 0.982. ± 0.092 | 1.007 | 0.850–1.062 |

Notes: Groups (#), number of groups in which data were available; participants (#), number of participants nested within groups; SD, standard deviation; Mdn, median; BMD, bone mineral density, BMI, body mass index; –, insufficient data (<3).

*BMD assessment characteristics*

All three studies used dual-energy X-ray absorptiometry (DEXA) for assessing LS and FN BMD [25,44,45]. Two studies used the Lunar Prodigy instrument [25,45] while the other used the Hologic QDR 4500 [44]. With respect to the site of LS BMD assessment, two studies assessed BMD at the L2–L4 sites [44,45] and the other at the L1–L4 sites [25]. Insufficient data were reported on the site-specific reliability of the instruments for assessing FN and LS BMD.

*Risk of bias assessment*

All three studies were considered to be at a low risk of bias with respect to randomized sequence generation, blinding and incomplete outcome data (attrition bias) [25,44,45]. In contrast, all three studies were considered to be at an unclear risk for bias in relation to allocation concealment and incomplete outcome reporting [25,44,45].

*Changes in primary outcomes*

*Changes in FN BMD*

Changes in FN BMD are shown in Table 3 and Fig. 2. Overall, a moderate and statistically significant benefit of exercise on FN BMD was observed as well as a trend for a statistically significant and moderate amount of heterogeneity. No outliers were detected and no adjustment for small-study effects was necessary. The 95% PI was −0.542 to 6.590. With each group deleted from the model once, the study by Zeilman [45] had the most significant influence, resulting in a large and statistically significant benefit when excluded and non-significant results when pooled with each of the other groups (Fig. 3). When results were collapsed so that only one $g$ represented each study, results were small, non-significant, and with a large and statistically significant amount of heterogeneity ($g = 0.284$, 95% CI = −0.946, 1.514, $p = 0.65$, Q = 5.2, $p = 0.02$, $I^2 = 80.8\%$).

*Changes in LS BMD*

Changes in LS BMD are shown in Table 3 and Fig. 4. As can be seen, a trend for a small and statistically significant benefit of exercise on LS BMD was observed. This was equivalent to a relative benefit of approximately 1%. No heterogeneity was found. In addition, no outliers were detected and no adjustment for small-study effects was necessary. The 95% PI was −0.176 to 0.556. With each group deleted from the model once, the exercise and milk group in the study by Kukuljan et al. [25,45] had the most significant influence, resulting in a statistically significant benefit of exercise on LS BMD when excluded from the model (Fig. 5). When results were collapsed so that only one $g$ represented each study, results remained small with a trend for statistical significance and no heterogeneity ($g = 0.190$, 95% CI = −0.036, 0.416, $p = 0.10$, Q = 0.04, $p = 0.98$, $I^2 = 0\%$).

*Changes in secondary outcomes*

Changes in secondary outcomes are shown in Table 3. As can be seen, no statistically significant benefit of exercise was observed at the total hip. In addition, no significant heterogeneity was observed and no outliers were detected. With each group deleted from the model once, results remained non-significant. When findings were collapsed so that only one $g$ represented each study, results remained non-significant with a small amount of non-significant heterogeneity ($g = -0.024$, 95% CI = −0.341, 0.294, $p = 0.88$, Q = 3.13, $p = 0.21$, $I^2 = 36.2\%$). For body weight, a small non-significant reduction was observed as well as no statistically significant heterogeneity. In addition, no outliers were found. When each group was deleted from the model once, results remained non-significant with no statistically significant heterogeneity. When findings were collapsed so that only one ES represented each study, results remained non-significant with a small amount of non-significant heterogeneity (−0.06 kg, 95% CI = −0.24, 0.11 kg, $p = 0.48$, Q = 0.58, $p = 0.45$, $I^2 = 0\%$). For BMI, there was a trend for a small, statistically significant reduction along with

**Table 3**
Changes in primary and secondary outcomes.

| Variable[a] | ES (#) | Participants (#) | Mean (95% CI) | Z ($p$) | Q ($p$) | $I^2$ (%) |
|---|---|---|---|---|---|---|
| *Primary* | | | | | | |
| Femoral neck | 3 | 187 | 0.583 (0.031, 1.135) | **2.07 (0.04)*** | **5.6 (0.06)**** | 64.0 |
| Lumbar spine | 5 | 275 | 0.190 (−0.036, 0.416) | **1.65 (0.10)**** | 3.0 (0.55) | 0 |
| *Secondary* | | | | | | |
| Total hip | 5 | 269 | −0.035 (−0.270, 0.199) | −0.30 (0.77) | 4.3 (0.37) | 6.0 |
| Body weight (kg) | 3 | 103 | −0.06 (−0.24, 0.11) | −0.71 (0.48) | 0.9 (0.64) | 0 |
| BMI (kg/m$^2$) | 3 | 103 | −0.19 (−0.41, 0.02) | **−1.75 (0.08)**** | 0.7 (0.71) | 0 |

[a] Unless noted otherwise, all outcomes are reported as standardized effect size ($g$); ES, effect size; #, number; participants (#), number of exercise and control participants nested within ES's and studies; Z($p$), $z$-score and alpha value; Q($p$), Cochran's Q statistic and alpha value; $I^2$ (%), I-squared.
* Statistically significant ($p \leq 0.05$).
** Trend for statistical significance ($p > 0.05$ to $\leq 0.10$).

| Study name | Subgroup within study | Statistics for each study: Hedges's g | Lower limit | Upper limit |
|---|---|---|---|---|
| Kukuljan et al., 2011 | exercise and milk | 0.911 | 0.467 | 1.355 |
| Kukuljan et al., 2011 | exercise only | 0.727 | 0.291 | 1.164 |
| Zeilman III, 2007 | none | -0.454 | -1.500 | 0.592 |
| | | 0.583 | 0.031 | 1.135 |

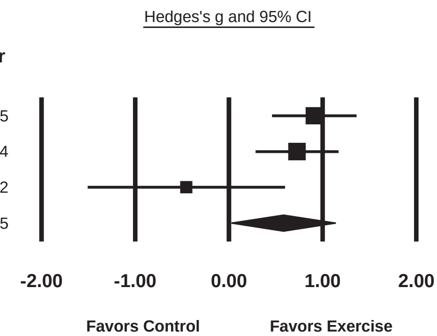


**Fig. 2.** Forest plot for changes in FN BMD. Forest plot for point estimate standardized effect size changes ($g$) in FN BMD. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals.

no statistically significant heterogeneity. This was equivalent to a relative reduction of approximately 2%. No outliers were observed. The 95% PI was −1.60 to 1.22 kg/m$^2$. With each group deleted from the model once, this trend no longer existed across any of the deletions. When findings were collapsed so that only one ES represented each study, there was a trend for a small, statistically significant reduction along with no statistically significant heterogeneity (−0.19 kg/m$^2$, 95% CI = −0.41, 0.02 kg/m$^2$, $p = 0.08$, Q = 0.63, $p = 0.43$, $I^2 = 0\%$).

## Discussion

To the best of the authors' knowledge, this is the first meta-analysis that specifically addresses the randomized controlled trial literature with respect to the effects of ground and/or joint reaction force exercise on FN and LS BMD in men. Overall, a moderate and statistically significant benefit was observed at the FN while a trend for a small and statistically significant benefit was observed at the LS. However, the findings for both FN and LS BMD were sensitive to influence analysis and/or collapsing multiple groups from the same study so that only one $g$ represented each study. For FN BMD, the study by Zeilman [45] appeared to be highly influential. Specifically, when deleted from the model, the overall benefits in FN BMD were considered to be large and statistically significant. However, when included with either of the other two studies deleted [25,44], the overall findings were no longer statistically significant. Furthermore, and not surprisingly, FN results also became non-significant when only one $g$ represented each study. This was most likely the result of a greater influence of the Zeilman study on the overall results [45]. Finally, the PI for estimating the expected results of a new trial crossed zero for FN BMD. While PI should not be confused with CI since the former are based on a random mean effect while CI are not [36], PI may be beneficial for future researchers interested in conducting randomized controlled intervention trials addressing the effects of ground and/or joint reaction force exercise on FN BMD in men.

While the overall results for LS BMD were not statistically significant, there was a trend for a small, statistically significant benefit (p = 0.10) with no apparent heterogeneity when analyzed at both the group and study level. However, results were statistically significant when the exercise and milk group in the study by Kukuljan et al. [25] was deleted from the model. The influence of this group on the overall results may have been the result of the $g$ for this study being calculated based on the difference between an exercise and milk versus milk only group as opposed to an exercise only versus non-intervention control group. In contrast, changes in LS BMD were no longer statistically significant when the other groups were deleted from the analysis. Finally, the PI for estimating the expected results of a new trial included zero.

Given the small number of $g$'s included and the instability of results, it is believed that there is currently insufficient evidence to *recommend* exercise as a singular intervention for improving and/or maintaining FN and LS BMD in men. However, similar to recent clinical practice

| Study name | Subgroup within study | Statistics with study removed: Point | Lower limit | Upper limit | Z-Value | p-Value |
|---|---|---|---|---|---|---|
| Kukuljan et al., 2011 | exercise and milk | 0.236 | -0.905 | 1.377 | 0.405 | 0.685 |
| Kukuljan et al., 2011 | exercise only | 0.314 | -1.013 | 1.641 | 0.464 | 0.643 |
| Zeilman III, 2007 | none | 0.818 | 0.506 | 1.129 | 5.147 | 0.000 |
| | | 0.583 | 0.031 | 1.135 | 2.071 | 0.038 |

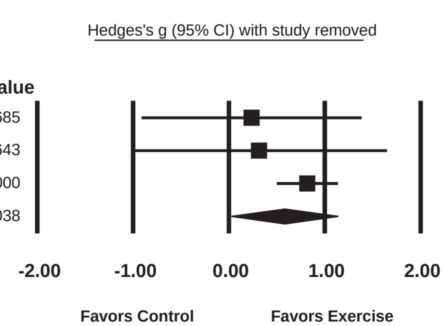


**Fig. 3.** Influence analysis for changes in FN BMD. Influence analysis for point estimate standardized effect size changes ($g$) in FN BMD with each corresponding study deleted from the model once. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Results are ordered from smallest to largest values of $g$.

| Study name | Subgroup within study | Hedges's g | Lower limit | Upper limit |
|---|---|---|---|---|
| Hong, 2004 | tai chi | 0.267 | -0.246 | 0.780 |
| Hong, 2004 | weight training | 0.172 | -0.344 | 0.687 |
| Kukuljan et al., 2011 | exercise and milk | -0.088 | -0.511 | 0.334 |
| Kukuljan et al., 2011 | exercise only | 0.436 | 0.009 | 0.864 |
| Zeilman III, 2007 | none | 0.181 | -0.854 | 1.216 |
| | | 0.190 | -0.036 | 0.416 |

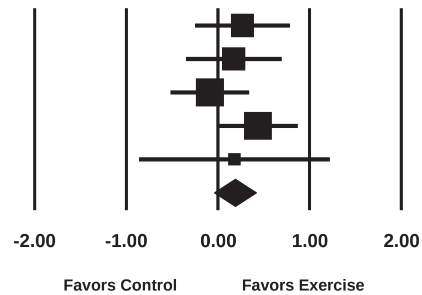


**Fig. 4.** Forest plot for changes in LS BMD. Forest plot for point estimate standardized effect size changes ($g$) in LS BMD. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals.

guidelines by the Endocrine Society on osteoporosis in men [46] it is *suggested* that men, especially those at risk for osteoporosis, participate in regular exercise. While the Endocrine Society guidelines suggest that men participate in weight bearing, i.e., ground reaction force exercise, three to four times per week for 30 to 40 min per session, the American College of Sports Medicine Position Statement suggests that adults participate in ground reaction force exercise, i.e., weight bearing endurance exercise, 3 to 5 times per week for 30 to 60 min per session as well as joint reaction force exercise, i.e., weight training, 2 to 3 times per week [47]. Despite the current lack of convincing evidence to support the use of exercise for improving and/or maintaining FN and LS BMD in men, it would seem plausible that adherence to the latter would be more appropriate, especially given the other benefits and minimal risk derived from participation in both [47,48].

For secondary outcomes, the overall results indicated no statistically significant changes for total hip BMD or body weight. However, there was a trend for a statistically significant reduction in BMI. While these results are interesting, secondary outcomes in any meta-analysis should be viewed with caution since they may represent a biased sample given that they are only included if data for the primary outcomes of interest are available.

While the results of the current meta-analysis are important, they should be viewed with regard to the following. First, the number of results for both FN and LS BMD was small. While some might consider the number of results too small for meta-analysis, it's important to realize that one of the very reasons for conducting a meta-analysis is when the number of results for a particular outcome is small. To support this contention, the Cochrane Collaboration currently recommends a minimum of two studies for inclusion in a meta-analysis [49]. The inclusion of a small number of studies in meta-analyses is common. For example, Davey et al., recently reported that the median number of studies included in a meta-analysis was three with an interquartile range of 2 to 6 [50]. Thus, the currently reported meta-analysis is consistent with contemporary practice. In addition, a minimum of 2 studies seems reasonable given that multiple participants are nested within each study. The former notwithstanding, the small number of studies in the current meta-analysis may limit one from generalizing beyond the populations included in each of the studies. Clearly, additional randomized controlled trials addressing the effects of exercise on FN and LS BMD in men are needed. This recommendation is consistent with the 2008 US Department of Health and Human Services Physical Activity Guidelines for Americans [51].

Second, two of the three studies included in the current meta-analysis were dissertations [44,45]. Some might consider the inclusion of such as inappropriate because of the perception that they are of lower quality when compared with research published in peer-reviewed journals. However, in a recent study by Moyer et al., it was concluded that unpublished dissertations should be included in comprehensive literature

| Study name | Subgroup within study | Point | Lower limit | Upper limit | Z-Value | p-Value |
|---|---|---|---|---|---|---|
| Kukuljan et al., 2011 | exercise only | 0.095 | -0.172 | 0.361 | 0.697 | 0.485 |
| Hong, 2004 | tai chi | 0.172 | -0.080 | 0.424 | 1.336 | 0.182 |
| Zeilman III, 2007 | none | 0.191 | -0.042 | 0.424 | 1.605 | 0.108 |
| Hong, 2004 | weight training | 0.195 | -0.058 | 0.448 | 1.508 | 0.131 |
| Kukuljan et al., 2011 | exercise and milk | 0.302 | 0.034 | 0.569 | 2.211 | 0.027 |
| | | 0.190 | -0.036 | 0.416 | 1.649 | 0.099 |

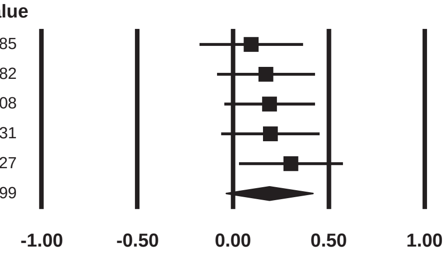


**Fig. 5.** Influence analysis for changes in LS BMD. Influence analysis for point estimate standardized effect size changes ($g$) in LS BMD with each corresponding study deleted from the model once. The black squares represent the standardized mean difference ($g$) while the left and right extremes of the squares represent the corresponding 95% confidence intervals. The middle of the black diamond represents the overall standardized mean difference ($g$) while the left and right extremes of the diamond represent the corresponding 95% confidence intervals. Results are ordered from smallest to largest values of $g$.

reviews, including meta-analyses [52]. Overall, they found that unpublished dissertations were not of lower quality when compared to those that were eventually published [52]. In addition, doctoral dissertations are (1) easy to access in comparison to other forms of gray literature, (2) free from some types of bias common in peer-reviewed literature, and (3) reported thoroughly [52]. To further support the inclusion of unpublished work such as dissertations, Cook et al., found that approximately 80% of meta-analysts and methodologists felt that unpublished material should definitely or probably be included in meta-analyses [53].

Third, because of the stricter study inclusion criteria for the current meta-analysis, including, lack of previous exercise, study design (randomized controlled trials only) and site assessed (FN and LS), none of the studies from the previous meta-analysis in men conducted more than a decade ago met the criteria for inclusion [19]. In addition, five randomized controlled trials published since the last meta-analysis were also excluded. The reasons for exclusion included (1) no clear indication of whether participants were physically active prior to enrollment [54], (2) participants serving as their own control [55], (3) previously exercising participants who were also allowed to exercise outside their intervention assignment [56], (4) no comparative control group (both groups exercised) [57] and (5) a lack of data specific to the FN and LS and which appeared to be strikingly similar to the included dissertation by Hong but with different authors [44]. Furthermore, two excluded studies included both men and women but separate data were not available for calculation of gs according to gender [58,59]. Given the former, it is the investigative team's belief that this new versus updated meta-analysis better reflects the current state of the randomized controlled trial literature with respect to exercise and FN and LS BMD in men.

## Conclusions

There is insufficient evidence at this time to recommend ground and/or joint reaction force exercise for improving and/or maintaining FN and LS BMD in men. Additional well-designed randomized controlled trials in men are needed before any final recommendations can be formulated.

## Acknowledgments

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.bone.2012.11.031.

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